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FRAUNHOFER CENTER FOR MARITIME LOGISTICS AND SERVICES CML

NEWS
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Tests of the numerous sensor technology and the ROV confirm the performance of SeaML.

THE AUTONOMOUS RESEARCH BOAT SEAML
RESEARCH PLATFORM FOR MARITIME INNOVATIONS

Our first research boat is an Autonomous Surface Vehicle (ASV) and is called SeaML. SeaML is equipped with autonomous assistance and navigation systems and serves as a modular development and demonstration platform for various innovations in nautics, sensor technology and maritime technologies in general.
The research boat is a catamaran with the dimensions 1.5m length and 1.2m width. The hulls are connected by a superstructure which serves as a flexible carrier for different technologies. SeaML has a payload of 40 kg and can therefore be equipped with extensive sensor technology, e.g. for high-precision depth measurement, environmental data acquisition and an underwater vehicle (Remotely Operated Vehicle, ROV). A web-based user interface has been specially developed for SeaML's mission planning, with which graphically supported services and work tasks can be defined, orders can be started and monitored, and the controller can be accessed. Thus, SeaML services can be requested and supervised from any location. The ROV is connected to a camera and further sensor technology with SeaML via a cable.
The first missions carried out with SeaML this summer included the development of innovative services for ports and the testing of a new type of hull coating: Robot-supported underwater inspections and automated real-time hydrographic measurements as a preliminary step to avoid groundings were successfully carried out. SeaML also served as a carrier for innovative communication technology and sensor systems of project partners. In addition, SeaML supported the observation of results under driving conditions as a test vehicle for an air-holding foil which reduces friction between the hull and water and thus reduces fuel consumption.
With SeaML's in-house development we have created a flexible platform that can be used for a wide range of different research tasks, supports our current projects and can be adapted for the development of new ideas and concepts.
The next stage of development will be the combination with a flying drone, which SeaML can use as a take-off and landing platform to gain a higher range and to offer air-based innovative services like inspection or surveillance. A special challenge will be the realization of a collection mechanism for maritime waste, whose miniaturized prototype will be tested with SeaML.
A second, larger SeaML is already being planned and will expand the CML fleet next year.

NEW INSIGHTS THROUGH KI USE
OPTIMIZATION POTENTIALS FOR EMPTY CONTAINERS

The timely provision of empty containers at the respective place of loading is a crucial component of global supply chains. According to current estimates, the associated transport costs alone are in the region of 20 billion USD per year. At present, the Fraunhofer CML and its project partner xChange, a leading global logistics marketplace for the brokerage of sea containers, are investigating how artificial intelligence can help to effectively reduce these costs.
The goal is to predict a Container Availability Index developed with machine learning techniques, which will serve logistics companies, freight forwarders and shipping companies as an information basis for planning and controlling container transports. Under the project title C-TIMING the project is funded by the German Federal Ministry of Education and Research.
First project results show that often already a targeted analysis of the existing data - in this case several million container journeys - reveals correlations from which savings potentials can be derived directly. In particular, the focus here was on additional costs in the event of late return of containers to the inventory of the respective shipping company. The analysis shows that in practice these often avoidable costs quickly reach four-digit figures for the individual company. For a cost-minimizing strategy, the large regional differences with regard to „demurrage & detention" (demurrage in port and costs for late return of empty containers) should be used.
The analysis and evaluation methods used in C-TIMING for large data volumes are universal and can be applied to many problems. We would be pleased to support you in the focused evaluation of existing data and identification of cost reduction potentials with the key technology Machine Learning and in the determination of suitable key figures and realizable findings for your company.

FOREWORD

Dear Readers,

in view of the special circumstances this year, we are pleased that we were able to continue our projects and have again achieved exciting research results. In our workshop our research boat SeaML has been completed and successfully tested despite strict attendance schedules and distance rules. SeaML serves in several research projects as an autonomous surface vehicle, which is supplemented by an underwater and a flying drone to test innovative solutions.

Furthermore, you can read about other application examples that we are currently pushing forward with the help of digitalization in ports and in the maritime transport chain.

I wish you and your family a particularly peaceful Christmas and all the best for a healthy and successful New Year, in which we will hopefully be able to meet again in person!

Your Prof. Carlos Jahn
Head of Fraunhofer CML

The Internet of Things enables more efficient and sustainable processes in the port.

INTERNET OF THINGS:
THE INVISIBLE NETWORK IN THE PORT

In a modern overseas port like Hamburg, it is not easy to keep track of things. Complex logistics chains from sea transport to goods handling in the port to the hinterland connection require the coordination of countless sub-steps and participants. Frictional losses are hardly avoidable - at least so far. What seemed unsolvable for a long time is now made possible by the so-called Internet of Things (IoT): the digital networking of many individual parts of a system with each other, which then exchange fixed information directly, automatically and in real time. Devices or vehicles communicate by means of small processors and embedded sensors. For example, they can communicate their locations to each other. With appropriate programming, devices, machines and systems can autonomously accept and process previously defined tasks.

The I2PANEMA research project („Intelligent IoT-based Port Artefacts Communication, Administration & Maintenance") is exploring the framework conditions of digitized ports (smart ports). The project will test under real conditions how ports can become more efficient and environmentally friendly by digitizing processes using IoT. This is to be piloted and proven by a series of application experiments in selected business scenarios. The research and development teams are working together with port authorities, ship owners, telecommunications companies and intermodal terminal operators. Specifically, the project will work with the HPA (Hamburg Port Authority), DeltaPort, Bayernhafen, DSW21 (Dortmunder Stadtwerke) and other European project partners to develop IoT applications in the ports of Hamburg, Wesel, Dortmund, Nuremberg, Gijon (Spain) and Derince (Turkey) and derive an IoT reference architecture. In this architecture, self-steering container stackers, intelligent light masts and autonomous gantry cranes will be optimally interlinked - thanks to IoT. The self-steering container in agile logistics chains is also reflected in this vision of seamless IoT interoperability of European seaports, which could culminate in a network of smart ports or fully digitized ports. The networking of all these components would not be possible without IoT. The I2PANEMA project is now collecting findings on how to optimize the interaction in the respective digital „ecosystem" and how to evaluate the information gained.

The dashPORT project - short for „Port Energy Management Dashboard" - pursues another approach to digitizing port operations. Here, the focus is on previously unused potential for saving energy. This has two positive effects at once, since emissions can be saved in addition to immense costs.
In order to record the electrical consumption of all relevant consumers in the entire port environment in detail and in real time at the terminal, around 500 digital remote-readable electricity meters are currently being installed. The measured values are transmitted by IoT and continuously evaluated and processed by Machine Learning. By determining and displaying the power consumption in a central, clear dashboard, dashPORT enables the more conscious use of energy-intensive consumers and the saving of avoidable energy consumption. In addition to preparing information for easier evaluation by the user, the algorithms can reliably forecast consumption peaks, which result, for example, from knowledge of upcoming ship arrivals and the associated handling activities. This makes energy management in the port more transparent and easier to control.

Despite all the new possibilities for digitizing ports, one challenge remains: To ensure smooth communication within the entire complex IoT system so that compatibility within the overall system works. The savings potential through leaner logistics processes using automation and smart measurement technology is enormous, but this requires a common technical standard for IoT applications. For successful networking and information transfer, all components must have appropriate interfaces and the data formats must be coordinated. This will allow port and terminal operators in the future to improve the efficiency of work processes in ports and thus increase their goods turnover, manage port traffic better and more securely and reduce emissions (noise, light, air, water). The presented projects at the Fraunhofer CML drive these approaches.

IN BRIEF

Maritime Innovation Update, *MIU for short: this is the title of our new lecture series. Every Friday at noon our scientists present selected research results. In just 15 minutes, at the start of your lunch break, you will gain exciting insights into our diverse topics. Remaining questions can be asked afterwards, or you can contact our speakers directly. In November and December the participants have already heard about autonomous shipping and its effects on ports as well as about crew planning tools for maritime shipping. In January we will continue with, among other things, emission measurement in maritime shipping and our ship simulators. Find the current lecture topics (soon also in English) on our homepage and register now. We are looking forward to meeting you!*

If you are on the road in Harburg at the inland port, you can hardly miss it: ***our new building*** *reached its final height in November. The shell of the building has been completed and is now being prepared for the cold season and the interior work. We can still plan to move into the building with its 1,600 square meters of office and 800 square meters of workshop and laboratory space in the fall of 2021. We are very much looking forward to this, as our number of employees and our spectrum of research topics is constantly growing. From the beginning of 2021, our new research field „Port Technology" will begin its work.*

+++DATES+++

- ***Maritime Innovation Update,*** *the online lecture series of CML, each Friday at 12:00*
- ***SMM 2021 Digital****, 2. to 5. February 2021*
- ***transport logistic,*** *4. to 7. May 2021, Munich*

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