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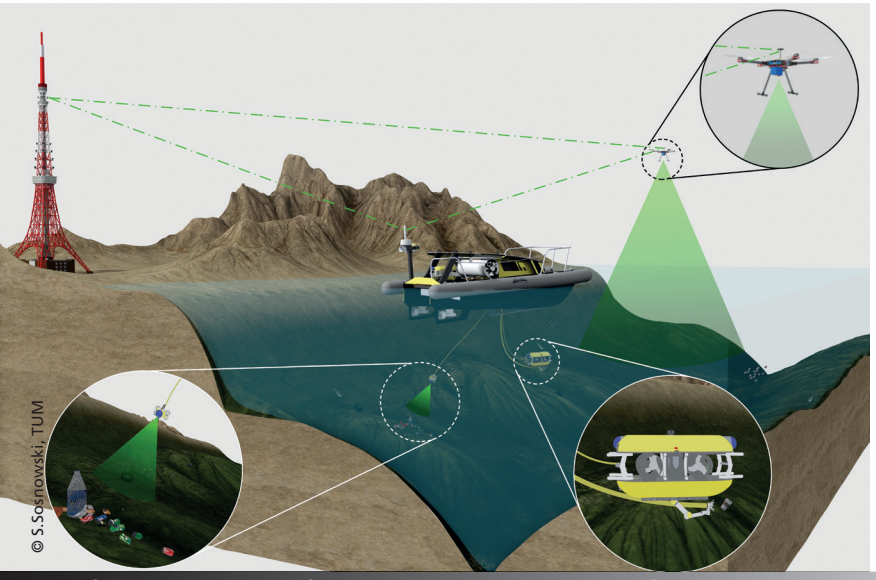
FRAUNHOFER CENTER FOR MARITIME LOGISTICS AND SERVICES CML

NEWS
1.20

CLEAN OCEANS THANKS TO ROBOTS AND AI
SEACLEAR FIGHTS MARINE POLLUTION

Autonomous surface and underwater vehicles represent a constantly growing research area at the CML. Now, with SeaClear, a new ambitious EU research project with participation of the CML aims to use these vehicles to identify and collect marine litter from the sea.
Today's oceans contain many millions of tons of waste, of which more than 90% is found on the sea floor. So far, efforts to collect the waste are mainly concentrated on surface waste, while little effort is being made to collect underwater waste. A research team of eight partners from Germany, the Netherlands, Croatia, France and Romania is now working to develop SeaClear. The goal of SeaClear - an acronym for „SEarch, identificAtion, and Collection of marine LittEr with Autonomous Robots" - is to develop and deploy autonomous robots for waste disposal. This includes the identification and mapping of objects on and under water as well as new developments in robot control. When the SeaClear system is fully operational, it is expected to detect and classify underwater waste at 80% and collect it with a success rate of 90%.
The SeaClear project will involve a mixed team of unmanned underwater, surface and aerial vehicles to find and collect litter from the seabed and from the water column, focusing on coastal areas since that is where waste inflow concentrates. The aerial and underwater robotics will be used for mapping the litter, aiming to establish correlations between surface and underwater litter. Finally, combined suction-gripper manipulators will be used for the collection. The developed system will be tested in two case studies in the port of Hamburg and in a tourist area in Dubrovnik. SeaClear receives 5 million euros in funding from the European Union's Horizon 2020 research and innovation programme.
The central tasks of the CML are the technical coordination and integration of the overall robotic system. In this context, the hardware and software infrastructure as well as the interfaces for data exchange between the robot vehicles and a land control centre are designed and implemented. The reliable and robust transmission of information is a decisive prerequisite for the land control centre to be able to control the deployment, navigation and monitoring of the unmanned vehicles later on.
Read more about SeaClear at https://seaclear-project.eu/.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In the future, robots with artificial intelligence could clean the sea floor.

TERMINALS FOR INTERMODAL TRANSPORT
DYNAMIC PLANNING AND SIMULATION

In the ISI-Plan project, the CML and its partners develop a software tool for planning intermodal transport terminals. The tool combines the proven planning environment visTable of Plavis GmbH and the simulation capacities of Enterprise Dynamics of INCONTROL GmbH.
The CML has analyzed and formulated the requirements for the software: With the ISI-Plan software it will be possible to determine the dimensions of the facilities in terms of areas, cranes, path networks, parking areas, transfer positions and number of vehicles for vertical and horizontal transshipment and to test the performance of the facility under these premises. For this purpose, the expected timetables, the expected modal split and the expected loading units by type are entered as auxiliary conditions and the terminal is thus sketched. The ISI-Plan software can map both bimodal and trimodal terminals.
The software enables terminal operators and planners to quickly execute operating scenarios and examine them by means of simulation. Investments can thus be analyzed in advance.
Up to now, the planning of facilities has mainly been based on existing experience in terminal operation. With ISI-Plan this knowledge is made available to users in a mathematically validated form. ISI-Plan thus makes an important contribution to the transfer of freight traffic to rail and inland waterways. The Fraunhofer CML coordinates the ISI-Plan project, which is funded within the „KMU-innovativ" program.

FOREWORD

Dear Readers,

The year 2020 has started for the CML with new exciting projects. By participating in the EU-funded research project SeaClear, we are working on a system of surface and underwater vehicles and flight drones to locate, identify and collect marine waste. With the disposal of marine litter, we make an important contribution to the sustainability of the maritime economy.
One topic that has been with us for some time is the use of artificial intelligence in the analysis of large amounts of data. With its help, we have already been able to solve tasks as diverse as forecasting truck waiting times at terminal gates, accurately predicting ship arrival times in German seaports and analyzing expected damage during regular ship operations with very good results.

Read about this and other news in our current newsletter!

Enjoy reading,

Your Prof. Carlos Jahn
Head of Fraunhofer CML

No contradiction: Seafaring romance and digitalization on the high seas.

ARTIFICIAL INTELLIGENCE PROMOTES AUTOMATION ON BOARD AND IN PORTS

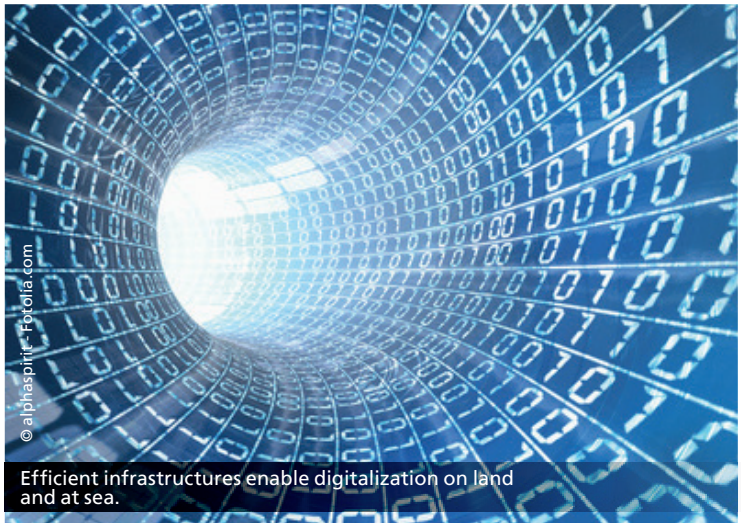
Innovation leap watchfree bridge

The major challenges facing maritime transport include coping with the growing volume of trade, improving maritime safety, economic efficiency and environmental friendliness.
In the course of advances in information technology, these challenges have led to the rapid development of autonomous technologies. Within the framework of the BMWi-funded research project B ZERO, the Fraunhofer CML is now developing a sensor and navigation system in cooperation with Wärtsilä SAM, Hoppe Bordmesstechnik, NautilusLog, the Bernhard Schulte Group, the Federal Maritime and Hydrographic Agency and the Fraunhofer FKIE. The system should be able to guide a ship autonomously between defined departure and arrival points, so that manning the bridge around the clock is not necessary.
The Fraunhofer CML will develop an artificial intelligence for autonomous navigation by using reinforcement learning in B ZERO. With reinforcement learning a system can train meaningful decision guidelines without prior knowledge, only by results or responses to its actions. Reinforcement Learning is already used at CML in the fields of object recognition and robotics, and supports the anticipatory avoidance of collisions and grounding in nautical situations. The AI, which will later take over autonomous navigation in B ZERO, is trained at the CML by simulating nautical scenarios with different parameters such as number of approaching ships, sea area, visibility and weather conditions. The decision component to be trained, e.g. collision avoidance, knows the required state of these given conditions and reacts with the learned, appropriate voyage and/ or course changes to ensure a safe passage on a route. The expected result is a prototype system, which will be further developed in the simulation laboratory environment of the CML and validated by future tests on board a cargo ship.

Efficiency boost in image recognition

Great potential for maritime logistics results from the use of AI-supported image recognition, or computer vision in short. In addition to the acquisition of digital images, it enables their processing into highly compressed numerical information that can be further processed by machines. Computer vision is thus a key technology for the automated observation of conditions and the detection of changes. These capabilities enable a wide range of applications in the maritime sector. In maritime shipping, for example, many autonomous manoeuvres depend on the permanent, simultaneous and reliable situational awareness that computer vision enables. Gradual changes, such as erosion of quay walls or deformations of a ship's hull, can be detected by computer vision, as can the position of cargo units on board or at the terminal.

The CML supports companies in the maritime industry in identifying and exploring the individual possibilities of computer vision. As part of the COOKIE project, which is funded by the IHATEC programme, a visual damage recognition and image-based repair prognosis of empty containers is being developed using artificial intelligence. This will not only ensure compliance with applicable security standards, but also make inspection procedures at the terminal gate more efficient.
In addition to computer vision, the CML has a broad spectrum of expertise in the field of machine learning and offers comprehensive solutions for AI-supported forecasting and assistance systems, from proof-of-concept to implementation.



Efficient infrastructures enable digitalization on land and at sea.

IN BRIEF

*At the next **Hamburg Innovation Summit HHIS 2020**, six Hamburg Fraunhofer institutions will jointly present current research results. In addition to CML, the Fraunhofer institutions IME (molecular biology), IAPT (3D printing), IAP (nanotechnology), ISIT (silicon technology) and MEVIS (digital medicine) will take part. Due to the current situation, the HHIS has been postponed and a new date has not yet been set. All information about the current events can be found at www.cml.fraunhofer.de.*

*The **new building for the CML** on the Harburg Lotsekanal is taking shape: after the floor slab was laid at the end of 2019, the shell construction has now begun. This is to be completed by autumn and then the interior work will begin. For the planners, architects and builders, this means making a large number of decisions to create ideal conditions for the laboratory and research environments, which are to be ready for occupancy in autumn 2021.*

+++DATES+++

- ***European Navigation Conference 2020**, 11.-14. May 2020, Dresden*
- ***Crew Connect,** 28.-30. October 2020, Amsterdam*
- ***Oceanology International,** 1.-13. December 2020, London*

IMPRINT

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