Navigating with Augmented Reality: Improving Maritime Situational Awareness

The use of augmented reality (AR), i.e. the addition of computer-generated information to real images, has already become established in various areas. However, AR applications have so far been rare in shipboard operations. Yet this is precisely where an interesting field is opening up. In view of the increasing digitization of shipping, the availability of data on the current nautical situation or details of the ship's operating status is constantly increasing. At the same time, the manning levels on many ships are decreasing. It is imperative that safe operation remains guaranteed. Fraunhofer CML employees have been conducting research in this area of conflict for several years.

To ensure that the large amount of information available on board can be processed and made applicable for different users in a targeted manner, a great deal of preliminary work must be done: In addition to analyzing the user-specific information required for individual maneuvers, the data available on the ships plays a decisive role. And last but not least, the presentation of the data must be complete for all individual users, yet easy to implement: Data on ship position and movement, relevant environmental data, and nautical information on approach and specified berth, supplemented by the current maritime traffic situation, enable a pilot to control the ship from shore as well. Camera systems and other optical monitoring sensors can provide important information from the maneuvering stations to the bridge to give the watchkeeper a more comprehensive overview than is currently possible.

Thus, the use of AR for ship control and pilotage, for example, offers the opportunity to further improve efficiency and safety. The latest findings on the use of AR in the maritime sector are summarized in the Fraunhofer CML white paper „Increasing Maritime Situational Awareness by Augmented Reality Solutions", which is available for free download on our website.

Resilience for Global Container Shipments - use of AI offers Solutions

Developments in recent years and weeks show that the resilience of our transport chains must increase in order to ensure the supply of national economies and economic performance. Flexibility to respond to new challenges and creativity for new, effective solutions are important steps on this path.

Ideas are beginning to emerge for container availability, which has been particularly impacted: For example, some carriers are offering priority services, using older containers longer, or trying to reduce the time until a container is next used by shortening unloading times. On the customer side, early and detailed bookings can help to ensure timely delivery of the container. Nevertheless, one thing above all is currently required: a high degree of flexibility from all participants in the maritime supply chain. This can be supported by the use of data-driven methods and applications of artificial intelligence (AI), as developed in the recently completed C-TIMING project by Fraunhofer CML and the logistics marketplace Container XChange. Algorithms analyze extensive amounts of data and bring insights into the current situation and the complex interrelationships along supply chains. In addition, AI applications can determine best possible decisions as well as forecasts about future developments. The information is available to users in so-called smart services. This includes, for example, the calculation logic for a Container Availability Index, which determines the regional and supraregional availability of empty containers from millions of container trips.

C-TIMING was funded by the BMBF.

Foreword

Dear Readers,

We are very excited that 2022 will be the year of resurgent exchange with you! Some events in the maritime industry have already gone live and also our lecture event Maritime Innovation Insights will be a hybrid format for participants to exchange face-to-face with our researchers as well as with each other.
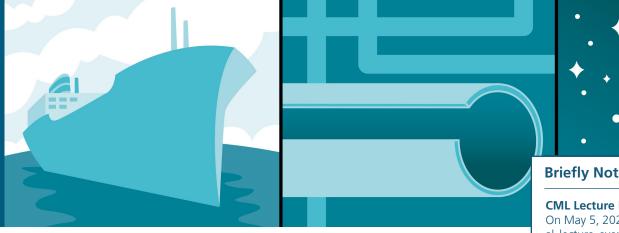
In this newsletter, we would like to present new developments on the use of augmented reality in navigation. The selection and provision of relevant information using data glasses is a fascinating field and offers great potential.

Data analysis of container transports enables a better understanding of current difficulties and thus provides the basis for reactions and changes towards more resilience, which is important for all of us these days.

Finally, let us take you into the realm of bionics - to ideas that we take from nature and turn into successful process and product innovations.

I hope you enjoy reading this issue!

Prof. Carlos Jahn
Head of Fraunhofer CML

Learning from Nature: Product Optimization through Bionic Know how

It is fascinating what nature has „invented": Over millions of years, it has continuously adapted to the conditions of the environment and given both animals and plants the appropriate tools to grant them the best possible conditions for survival. This principle can also be applied to technological issues.

How would nature solve the problem?
We can learn from nature and copy its principles, materials and systems in order to apply them to product development. The Fraunhofer-Gesellschaft uses this form of biological transformation within its research projects and benefits from the bionic know-how it has acquired over the years: We develop innovative, bio-inspired solutions for economic and technical issues.

Examples of bionic approaches of the CML
The latest example of this kind is the BMBF-funded AIRTUBE project: a project we are co-ordinating to minimize friction losses in pipes, which also reduces energy consumption. AIRTUBE emerged from the EU-funded AIRCOAT project, in which the properties of the tropical floating fern Salvinia were used to develop an artificial film: The film, applied to a ship's hull, forms a thin layer of air in contact with water. This effect reduces the friction between hull and water, which in turn decreases the energy required for propulsion and thus fuel consumption and pollutant emissions. The layer of air around the hull dampens the propagation of sound and reduces noise emissions. If these findings are transferred to water tubes, an air-retaining layer on the inside walls of a pipe will reduce the pressure loss along the pipe and therefore show a greater energy efficienciy in fluid transport. Nature's model, the Salvinia effect, leads to the bionic coating of surfaces with a permanent layer of air under water. This technology opens up further fields of application, and the sector of internal pipe coatings offers great potential. The aim of the AIRTUBE project is to develop a suitable demonstrator to show the technical feasibility. To this end, Fraunhofer CML is collaborating with the Karlsruhe Institute of Technology (KIT) and the Bremen University of Applied Sciences (HSB), accompanied by partners from industry. Another example of the innovative solutions from nature that bionics offers is the BIOIN-SPACED project. Here, 10 overall concepts were developed from 130 biological concepts, which present novel approaches to the disposal of space debris. A suitable subsystem was realized in the form of a demonstrator. What literally sounds remote has a good reason: Uncooperative objects in near-Earth or even geostationary orbits, such as old rocket stages or defective satellites, pose a great risk to both manned and unmanned spaceflight. Collisions can lead to an exponential increase of debris on important orbits, making them unusable - for a short time or permanently. As part of BIOINSPACED, the CML has identified, evaluated and combined biological concepts into holistic solutions to help combat space debris and further advance bionics in the space sector. The project, commissioned by ESA, was completed in February 2022.

Knowledge transfer for companies
Fraunhofer CML is making the knowledge it has acquired through these exciting tasks in the field of biological transformation available to other companies. We examine the extent to which traditional construction and manufacturing methods, or even design and production methods, can be bio-intelligently transformed - and thus comply with current environmental legislation and contribute to greater sustainability. For this purpose, we offer customer-specific workshops to analyze in a structured way for companies which bionic solutions for industrial products are conceivable and useful. For more information on our bionics workshop, please contact our team leader Johannes Oeffner at johannes.oeffner@cml.fraunhofer.de.

Briefly Noted

CML Lecture Event MII 2022
On May 5, 2022, we will host our annual lecture event **Maritime Innovation Insights**, or MII for short, as a hybrid event at the premises of TUTECH Innovation GmbH. From 10 am to 4 pm, project partners as well as our scientists will give live presentations on exciting maritime innovations. The topics will be optimization of fleet operations, real-time systems for smart ships, hydrogen logistics and water cargo barge as well as robotics and AI in port operations. We look forward to welcoming around 50 participants in person.
Guests who wish to participate online will have the opportunity to log in individually for the sequences. All information and the opportunity to register can be found on our website.
Subscribe to our newsletter and follow Fraunhofer CML on LinkedIn and Twitter for the latest info on events, downloads and relevant maritime topics!

Events

Maritime Innovation Update
Our digital lecture series,
each Friday at 12 pm

Nor-Shipping 2022
Solutions for maritime processes with the help of AR and data evaluation,
April 04-07, 2022, Oslo

Maritime Innovation Insights
The hybrid lecture event of the CML,
May 05, 2022, Hamburg