Extend your reality

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With the advancement of technology in recent years, the applications of efficient virtual (VR) and augmented (AR) realities have picked up speed. 360-degree head-tracking, offering a hi-res display and a high-frame rate, integrates the user with the digital environment stronger than ever. But it is not just the technology that's improving. VR and AR are increasingly used to create value-adding applications in various industries rather than solely for entertainment. The nautical sector itself offers many use areas for supporting already existing systems.

Depending on the use case, AR and VR applications differ fundamentally. Reality is enhanced with digital objects in the case of the former, while you are wholly immersed in a virtual world with the latter. For this purpose, additional visual information or objects are displayed on an AR-capable device. All of this happens in real-time. AR and VR can work as standalone solutions or be combined to enjoy the best of both worlds in particular cases.

Consolidating knowledge

Training workers can be difficult and ineffective in the event of contact restrictions and time constraints of trained staff. Many instructions are location-bound and only possible at a specific period. Yet, learning success must be achieved. VR can help overcome these barriers. 'Boarding' a virtual world that the user can influence is ideal for knowledge-enhancing scenarios. VR can reproduce many work processes around the port and ship environment. Accurate training sessions in a virtual world can better prepare users for real-world events.

For example, Fraunhofer CML and FIP@S2-Novia worked on a fast rescue boat simulation. The user is on a ship deck, guided through the complete process: preparing the equipment, communicating with the ship's bridge, lowering the boat, rescuing a POB (person-overboard), and returning and reattaching to the vessel. Users can move freely in the virtual world, with interactive overlays helping to find their way around and interact with it through inputs. The necessary work steps can be brought closer to the user in various ways. This technology is already used in the Aboa Mare Maritime Academy and Training Center in Turku.

The big advantage is the immersion that the user is experiencing here. In combination with gamification, learning success can be increased. The scenarios are infinitely reproducible and modifiable. The applications can be launched at any time from home and do not take up the time of several people. Examples include safety protocol sequences (fire extinguishing, doctoring) and training sessions (fast rescue boat, crane control).

Increasing maritime situational awareness

Other applications are AR-based. The fundamental difference compared to a VR application is that digital objects are projected onto the physical world. For this purpose, either special AR glasses or conventional smartphones are used. Since the perception of the real world is not affected by AR gear, they are particularly suitable for working around and on ships.

While sailing a vessel, navigators need to form a mental picture of the current situation to predict how a given decision might affect future situation development (the scientific term for the quality of this mental image is "situational awareness"). Nowadays, navigators receive a large part of the information about the vessel and the environment from sensors and all kinds of interfaces and systems: automatic identification, global positioning, radio detection and ranging, and automatic radar plotting aid. Furthermore, the electronic chart display and information system exhibit the vessel and its movement on an electronic navigational chart, likewise of nearby

Photo: Canva

ships in the automatic identification system's range. Along with a compass, steering wheel, the global maritime distress and safety system, and communications with the outside world, these are instruments relevant to a safe navigation watch.

All told, keeping track of everything all the time is a mammoth task. Moreover, one disadvantage of conventional displays is their high degree of abstraction with which information is presented. A navigator, for example, must do a certain amount of thinking to make the connection between the information displayed next to an abstract symbol on an electronic nautical chart and a ship visible in the environment. In addition, a particular piece of information is only available when the person on board is at a specific workspace location: in front of the display showing the required information. Usually, the navigator's attention is evenly divided (or scattered) among several screens.

AR offers a solution to most of these drawbacks: data sets from different systems can be merged and visualised according to the same design guidelines. Instead of distributing the various system information across multiple monitors at different physical locations, the data can be bundled and made available on demand. With the ability to place information about the state of the ship in the user field of view, AR offers the advantage that this information is provided independently of the navigator's position on the bridge, avoiding a division of attention between observing with one's own eyes and receiving information from displays or manuals. This allows the navigator to spend more time watching the surroundings ('heads-up time'), which can save valuable time, especially in critical situations.

AR can also superimpose whole areas in the environment with a semi-transparent overlay, making it possible for the navigator to identify risk areas immediately and change the vessel's course to steer clear of danger.

One challenge when developing AR solutions is to find a user-friendly interface. The balance between showing relevant information and preventing the user view field from cluttering must be found. Consequently, AR usability depends highly on a logic that prioritises information display.

VR and AR combined

Both technologies can additionally be used together to achieve optimal development results. A great effort must be expended in testing to develop value-creating AR applications. Especially in the ship's bridge area, it is not always possible to create optimal conditions to test at any time. Entire ships are busy elsewhere, and personnel may be working at full capacity. Some trials require particular weather conditions or environmental situations to be reasonably conducted. The probability of certain variables coinciding with the planned test time is very low.

VR is optimal for addressing this issue. Solutions can be tested in a completely digital setting as an intermediate step to the real integration of AR applications. In this case, the 'external circumstances' can be changed and manipulated at any time, providing perfect test conditions. There is no time limit for the tests, and there is freedom in the design and distribution of the participants. As a result, workers are optimally prepared in the event of the integration of the AR application.

The Fraunhofer Center for Maritime Logistics and Services CML researches these modern technologies. Check our ***Increasing Maritime Situational Awareness by Augmented Reality Solutions*** white paper to learn more. ■