

Autonomous Remote Operations using AUVs for Offshore Windfarm Inspection

Publieke samenvatting / Public summary

Aanleiding

Currently, offshore wind asset owners face high underwater inspection expenses due to the use of survey vessels, divers and wired solutions. Furthermore divers face high risks in executing inspection tasks and, as a result, asset owners increasingly expect their supplier to deliver 'diverless' contracts. Moreover, the availability of experts able to carry out underwater inspection is limited. Finally the desired surveying requirements cannot be met in deeper water because Multi Beam Echo Sounders are deployed near the surface, resulting in insufficient mapping resolution. Autonomous Underwater Vehicles (AUVs) have the potential to provide a more cost-effective, safer, sustainable, and potentially more accurate tool for underwater inspections. Because radio waves do not propagate well underwater, they are unable to use GPS for navigation and radio waves for communication. Therefore, the development of underwater connectivity and navigation solutions is needed.

Doelstelling

Within this PPS ARO project, knowledge was obtained regarding the performance of AUVs for (but not limited to) offshore bathymetric surveying. The two main results relate to the underwater connectivity and the underwater navigation.

Korte omschrijving

Underwater connectivity: Acoustic channel characterisation experiments were carried out in the

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Grevelingen estuary to better understand the communication performance (data rate and robustness) between an operator and an AUV. Analysis of the measured acoustic channels indicates that, by using the acoustic communication technology developed by TNO, it is possible to achieve robust communication at 4.5 kbit/s using 21 kHz bandwidth and a 16-QAM symbol constellation. This would allow the communication of periodic compressed sonar snippets and frequent status updates. The number of experiments carried out was however too limited to draw generalised conclusions regarding the robustness of the communication (percentage of messages successfully communicated). Furthermore, it is recommended to further test and optimise the acoustic communication technology for more realistic offshore conditions (deeper water and a wider variety of sea states).

Resultaat

Underwater navigation: To better understand and improve the navigation performance of AUVs, a Simultaneous Localisation and Mapping (SLAM) algorithm was developed. Furthermore, the TNO TOPS (Timing, Orientation, Positioning Service) Kalman filter was calibrated for the TNO lightweight AUV (LAUV). Next, its navigation performance was studied for three different “racetrack” experiments. It was observed that the developed SLAM algorithm reduced the estimated relative drift from ~2.5 m to ~1.3 m for a 400 m leg length. It was however not possible to quantify the absolute positioning accuracy because the error margin of the reference GPS solution was significantly larger (between 5-15 m) than the observed maximum drift of 7 m for this experiment.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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