

Defence-related Research Action - DEFRA

ACRONYM: SIREN

Title: Ship Intel foR the Belgian Navy

Duration of the project: 01/03/2024 - 28/02/2027

Key words: sensors hyperspectral C4i AI intel maritime

Budget: 1.935.100 €

of which RHID contribution: 1.563.572 €

PROJECT DESCRIPTION

- In the SIREN project, the partners aim at advancing the state of the art of maritime sensor systems and hence improving the common operational picture for traffic heavy coastal and near shore environments like the Belgian territorial waters and EEZ, by:
- Combining different data sources (both military and civilian) and maritime EO/IR sensor systems, with focus on state-of-the-art high-performance camera (amongst others SWIR and VNIR sensors);
- Integrating high performance, innovative sensor processing technology;
- Using artificial intelligence to enable automated vessel detection and anomaly detection, allowing to go from a post-factum to real-time analysis of the zones of interest;
- Performing a proof of concept with integration of the new functionalities into a real world maritime C2 platform, demonstrating their potential for operational workflows of the Belgian Navy (and potentially other maritime operators).

Given this project scope, SIREN is targeting following research efforts:

- Exploration of different wavelength ranges will be performed for the VIS/NIR/SWIR domain in the first phase of the project using a hyperspectral sensor.
- By selecting a number of state-of-the-art sensors (heterogenous in spectral band in operating principle) as well as the advanced, novel, broadband QD sensor, the project will optimally combine different sensor systems. The level of integration and fusion will be adapted to maximize detection characteristics. All the sensors are passive, favouring intrinsically a covert operation of the SIREN sensor suite. Additionally, a fusion with sensor systems already in use in the domain of ship surveillance (AIS, Radar, ...) will be studied.

- Another important part of the research effort will be focused on the level of automation of information extraction based on the gathered sensor data to optimally support the operator in taking decisions in complex situations, as well as the integration of the proposed hard-and software solutions into the current battlefield management system (the MIK 2.0 platform)

The general objective of SIREN is to prototype an automated imagery analysis platform with innovative functionalities such as perimeter control in an offshore wind farm, detection and tracking of small vessels as well as behaviour extraction of hybrid/military vessels.

To achieve this overall objective, following research objectives (RO) can be defined:

RO1: Definition of use case requirements and selection of optimal sensor/camera system

RO2: Development of machine learning algorithms for real-time automatic processing of multi-band vessel data.

RO3: Integration 'end-to-end' in a real life C2 system

To demonstrate the operational potential of the proposed concept, we will perform proof-of-concept tests at TRL level 5-6, in the operational environment of the MIK, targeted at three concrete use cases:

- 1) detection and tracking of small contacts (no or dampened AIS signal),
- 2) detection in a non-radar covered zone (North-Western part of our EEZ) and
- 3) a windfarm intrusion scenario. These use cases are identified as specific operational needs by the Belgian Navy staff and the Coastal Security partners. They are relevant in coping with security and safety threats, and illegal activities.

The main impact of SIREN's outcomes on Defence can be found in an improved situational awareness in the EEZ, an increased preparedness of the Coastal Security stakeholders, and better protection of the critical maritime infrastructure. Indeed, the offshore availability of an integrated intelligent multi-sensor solution (completed with a real-time AI assisted computer vision which is integrated in the automated workflow of the existing MIK 2.0 C2 application) will optimally support the operators in assessing and reacting to complex situations.

A detailed outreach and dissemination plan will be defined early (6M) in the project (D8.1.1), targeting different activities and groups. At least following efforts are foreseen:

- Demonstrations and workshops for the Belgian stakeholders, from Navy (including MIK, MOC, Innovation Officer COMOPSNV, DGMR) to share our findings (D8.1.2) and representatives of offshore critical infrastructure owners and operators BOP (Belgian Offshore Platform) and the TSO Elia, and Cell CMB of Fed. Dept of Mobility and Ministry of the North Sea. - End-to-end testing of the SIREN system in WP8 within the MIK environment, will be done against the user requirements defined at the start of the project. The results of and user feedback on the trials will be reported (D8.2.1). The initial use cases will be re-evaluated with the acquired knowledge and translated into technical requirements for the end-to-end solution with design suggestions for further

development of the MIK/MOC platform (D8.3.1). This will be important input for the planning of future investments (cf. STAR plan).

- In D8.4.1 a roadmap towards exploitation will be defined, focusing on the necessary concrete follow-up projects (research, product/system development and industrialization and marketing). This will include follow-up work in the naval and maritime domain, as well as other military and civilian applications with similar challenges. As protection of critical infrastructures is high on the international agenda, international cooperation projects will also be identified.
- On the academic level, publications and presentations for experts in the addressed domains will be generated.

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