Defence-related Research Action - DEFRA

ACRONYM: PARSEC

Title: Passive **A**I-powered **R**eal-time hemi-**S**pherical **E**dge-**C**omputing

Duration of the project: 1/12/2025 - 1/03/2030

Budget: 2.204.000 €

of which RHID contribution: 1.810.000 €

Key words:

- Hemispherical Situational Awareness
- Passive Sensing
- 3D mapping
- Edge computing
- Decision Aid

PROJECT DESCRIPTION

The need for hemispherical situational awareness is critical in the context of evolving warfare dynamics. The PARSEC project directly addresses this by proposing an automatic detection system based on acoustic, thermal infrared and visible sensors. The use of high-speed thermal sensors for muzzle flash detection will be investigated as well. This multi-source approach significantly improves the chances of detection and increases the reliability of the information gathered. We introduce a novel technique for passive distance estimation based on implicit calibration of a distributed multi-camera system with wide-angle lenses (VIS and LWIR). This is essential to represent the potential treats on a map.

The 3D-data that is gathered will be automatically interpreted by the system using AI-based machine vision algorithms and a situational awareness will be deduced from the capabilities, intent and opportunities of the detected objects. We include traditional targets such as personnel and vehicles, as well as the passive and early detection of UAVs, addressing a growing threat in modern combat scenarios.

The objects of interest will then be represented on a recognised land map together with a threat score. The information from the recognized land map can be shared between vehicles (manned or unmanned). By combining information from multiple vehicles, we can exploit the different viewpoints and increase the confidence of detection. Apart from the land map, there will also be a graphical user interface to present video information to the user and highlight the most relevant threats via overlays.

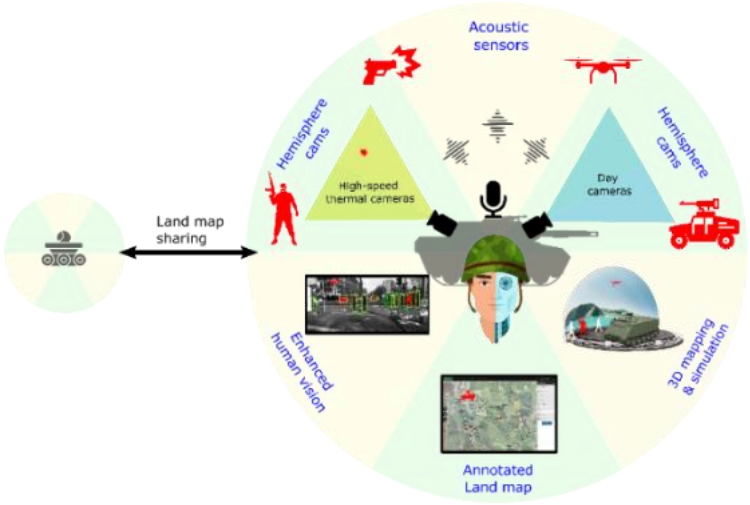
Finally, we provide a comprehensive simulation toolbox for the design, calibration and model training of the distributed multi-camera system, enabling continuous improvement and adaptation to new

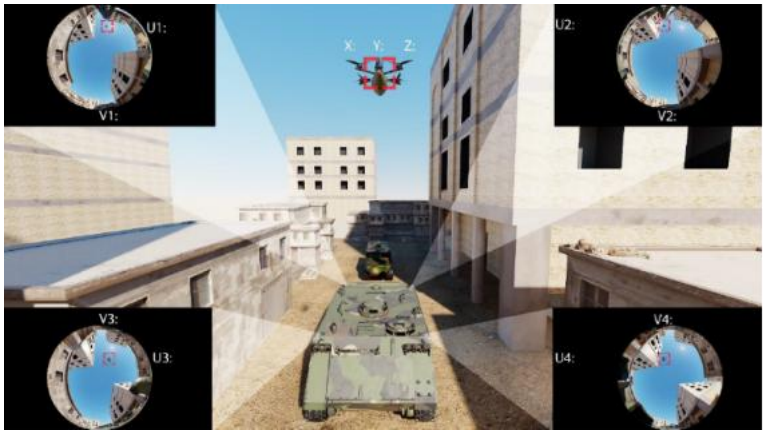
threats. Our project ensures real-time, realistic implementation (TRL 5-6) with a strong emphasis on Size, Weight, Power, and Cost (SWaP-C) at the system level, making it practical for future deployment on various vehicles, both manned and unmanned. We plan to collaborate closely with BeMOD to analyse and reduce cognitive load, ensuring that the system is user-friendly and effective under high-stress conditions.

The results of this project will give deeper insights into decision-making in crowded environments and into the most important cost/performance trade-offs for passive situational awareness systems. The concrete output will be in the form of demonstration moments to the stakeholders, scientific papers on the innovative techniques and recommended system requirements for a market-ready product.

Due to the flexible nature of our concept, results are not limited to specific sensor technologies or vehicles. There is significant expansion potential in follow-up initiatives by expanding the number of viewpoints, the type of data sources and by complementing the hemispherical detection with more directed observation (slew-to-cue).

The figures below visualize the envisioned PARSEC concept.





CONTACT INFORMATION

Coordinator

Patrick, Grenard
Optronic Instruments & Products (Sensor Systems)
patrick.grenard@oip.be

Partners

Steve, Vanlanduit
Universiteit Antwerpen / InViLab
Steve.vanlanduit@uantwerpen.be

Xavier, Neyt
Royal Military Academy / CISS - Remote Sensing Research Unit
Xavier.neyt@rma.ac.be

LINK(S)

Relevant links not yet available before the project start.