Defence-related Research Action - DEFRA

ACRONYM: NAV-ALERT

Title: Naval Alertness Monitoring System for Enhanced Operational Readiness

Duration of the project: 01/12/2024 - 01/03/2028

Key words: Alertness monitoring, UWB activity recognition, DEAP stress monitoring

Budget: 1.502.862 €

of which RHID contribution: 1.301.134 €

PROJECT DESCRIPTION

Understanding the health status of crew members is essential for ensuring operational effectiveness in naval military scenarios. During combat or crisis situations, real-time information about crew members' location, health, stress levels, and fatigue is crucial for critical decision-making. This enables commanders to identify individuals vulnerable to Acute Stress Reactions (ASRs), facilitating timely interventions to mitigate risks. Additionally, it supports crew members showing signs of fatigue or high stress, optimizing their performance and well-being in high-pressure situations.

This information is valuable not only in combat scenarios but also during training sessions. It provides essential data to understand crew health dynamics during emergencies, anticipate stress buildup, and adjust the training programme accordingly. Thus, alertness detection technology can improve readiness for real crises while optimizing training protocols, ultimately enhancing the navy's operational resilience.

NAV-ALERT's Objective

NAV-ALERT aims to enhance operational insight into crew health and stress levels during training and crisis situations. To achieve this goal, two innovative technologies will be introduced:

1. **DEAP Sensor Technology**:
    - Physiological parameters such as breathing, heart rate, and body temperature will be measured using stretchable Dielectric Electro Active Polymers (DEAP). Beside the DEAP, the system also contains an Inertial Measurement Unit (IMU) sensor and a temperature sensor. This combination allows to provide the ideal data to construct an AI-model.

- Bainisha will focus on improving structural integrity, measurement accuracy, and battery life to enable long-term, reliable crew health monitoring. A lot of attention will be paid to methods to optimise the confidentiality and safety of the data.

2. **Ultra-Wideband (UWB) Sensors**:
    - UWB sensors will provide contextual information about crew positions and activities.
    - MagicView and imec will develop algorithms capable of detecting body orientation and activities (such as sitting, walking, falling, doing maintenance handlings and during guard) and correlating them with high accuracy.

Advanced Data Analysis and Visualization

Based on physiological and contextual features, imec will develop explainable machine learning algorithms to accurately assess stress levels, alertness, and fatigue. These algorithms will also detect anomalies in the data, such as freezing reactions or overboard risks.

ePoint will translate these complex assessments into easy-to-understand insights, such as a traffic light system indicating key performance levels for each crew member. Advanced visualization techniques will present this information clearly and concisely. All partners will collaborate to optimize the algorithms for deployment on Cortex M3 edge devices.

Validation in Realistic Environments

The technologies will be tested in various environments:

- **Year 1**: Laboratory conditions.
- **Year 2**: HomeLab environment with simulated activities.
- **Year 3**: Belgian Navy training facility, including a frigate and firefighting exercises.

Two Proofs of Concept (PoCs) will be demonstrated: one in the HomeLab test environment and another in a realistic operational setting. These iterative test campaigns will enable the Belgian Defense to better evaluate the benefits of wearable technologies and sensors for long-term operations and emergency scenarios. All technologies will be validated up to TRL 5 for maximum operational readiness and resilience.

Conceptual illustration of NAV-ALERT

CONTACT INFORMATION

Coordinator
Eli De Poorter
IDLab, imec & Ghent University
eli.depoorter@imec.be

Partners
Alain Bicqué
Bainisha BV
alain.bicque@bainisha.com

Philippe Vanhoutte
Magicview
philip@magicview.tv

Ronny Broekx
ePoint
ronny.broekx@gmail.com

LINK(S)

/