TOP TEN

Paul Lee
University of Strathclyde

Category: **Waterborne** Country: **United Kingdom**

Research Area 3: **Efficient & Resilient Systems** Idea Number: **21**

Robust Reactive Collision Avoidance System for Autonomous Ships Amidst Limited Sensory Information and Unclassified Surface Obstacles

The recent maritime industry has been transitioning to the new era of Shipping 4.0 propelled by the vision of a more sustainable future. Autonomous ships, also known as Maritime Autonomous Surface Ships (MASSs), are envisioned to be the main ecosystems of Cyber-Physical Systems (CPSs) with the potential to unlock new levels of sustainability. However, prior to their full-scale adoption, new challenges pertaining to safety-critical operations need to be addressed, such as collision avoidance. In particular, ensuring safe and efficient collision avoidance of MASSs under uncertainties is an ever-increasing key challenge. To tackle this, a novel idea is proposed to develop a reactive collision avoidance system for MASS with robust decision-making and scenario-classification capabilities amidst limited sensory information and unclassified surface obstacles. This idea is formulated into a systematic methodology that consists of the development of a high-fidelity digital twin environment, development and training of Artificial Intelligence (AI)-based agents for decision-making and scenario-classification, and verification of the system's robustness. Simulation results verify that the decision-making agent can generate efficient, safe, and CORLEGs-compliant evasive manoeuvres even outside of the training envelope. Also, the scenario-classification agent can identify a static or dynamic scenario with accuracy above 82.8%. Finally, the developed system can handle reactive collision avoidance amidst a wide range of unclassified obstacles resembling surface obstacles with radii of 4-470 m and target vessels ranging from 12-104 m in length. This idea contributes to the future of sustainable maritime industry by paving the way for robust autonomous systems in safety-critical applications.