Robotic Detection and Removal of Ghost Nets

Abstract: Ghost nets, essentially fishing nets that have been abandoned, lost or discareded, represent a major problem. Ghost nets and other fishing gear are responsible for trapping and killing significant amounts of marine life and can also cause further destruction including destroying shorelines, smothering coral reefs or even damaging boats. Unfortunately, the problem remains largely not addressed and gets greater by the day. Finding and collecting such ghost nets represents a complicated task that so far relies on sparse and small teams – often volunteers – that try to perform cleaning operations. As it is a time-consuming, challenging and often risky task robotics can play a significant role and undertake a major part of the activities. In this project, we seek to develop a robotic system-of-systems that involves a duo of units that can be tugged by a larger vessel and offer searching of the bottom of the sea in order to detect ghost nets, as well as cutting and lifting of such ghost nets. Within the project, you are tasked with the goal of designing such a system and demonstrating its potential use case in small-scale operations within a lab environment.

Tasks:

- Study of literature in order to understand the problem of ghost nets.
- Develop vision-based method and system for the detection and classification of ghost nets.
- Develop a (set of) robotic manipulator(s) to a) cut ghost nets, and b) attach balloons for them to be lifted.
- Develop a duo of robotic systems for ghost net detection, cutting and retrieval with the robotic units being tugged by a larger vessel on the surface of the sea.

Literature (indicative):

[1] Pedersen, E.M., Andersen, N.G., Egekvist, J., Nielsen, A., Olsen, J., Thompson, F. and Larsen, F., 2021. Ghost nets in Danish waters. by: National Institute of Aquatic Resources, Kemitorvet, 2800 Kgs. Lyngby, Den-.

[2] Gunn, R., Hardesty, B.D. and Butler, J., 2010. Tackling 'ghost nets': local solutions to a global issue in northern Australia. Ecological Management & Restoration, 11(2), pp.88-98.

[3] Perroca, J.F., Giarrizzo, T., Azzurro, E., Rodrigues-Filho, J.L., Silva, C.V., Arcifa, M.S. and Azevedo-Santos, V.M., 2022. Negative effects of ghost nets on Mediterranean biodiversity. Aquatic Ecology, pp.1-7.

[4] Kim, J., Kim, T., Kim, J. and Yu, S.C., 2019, November. Manipulation purpose underwater agent vehicle for ghost net recovery mission. In 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 3905-3910). IEEE.

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