LoRaMAR - Collaborative Network of Micro-Robots for Environmental Monitoring in Aquatic Environments

DOI: COFAC/ILIND/COPELABS/1/2025

Project Reference: https://doi.org/10.62658/COFAC/ILIND/COPELABS/1/2025

Francisco Fernandes Castro Rego
Principal Investigator

02/01/2026-01/07/2027
Project Duration

Team members and host UI&D:

Francisco Rego[1,2,3], Luís Pires[3], Ricardo Santos[4], Fernando Duarte[5,3], Susana Pires[6,3], Slaviša Tomić[1,2]

1 – COPELABS, ECATI, Universidade Lusófona

2 – - UNINOVA-CTS - Center of Technology and Systems, NOVA School of Science and Technology

3 – CI – IPLUSO (LIC)

4 – GOVCOPP (UAveiro)

5 – DREAMS

6 - CIEBA

Abstract:

Portugal has an extensive coastline and sensitive marine areas where continuous environmental monitoring is particularly challenging. The need for real-time data collection in remote locations, such as estuaries, coastal zones, or nearby oceanic areas, demands accessible and resilient technological solutions. The growing awareness of climate change, marine pollution, and sustainability reinforces the urgency of developing decentralized, mobile, and autonomous environmental monitoring systems.

This project proposes the development of low-cost prototypes of mobile robots, equipped with environmental sensors and LoRa communication, for real-time data collection and transmission. The robots, low-cost autonomous sailboats, will operate cooperatively, using coverage and distributed communication algorithms, enabling the

creation of mobile sensor networks in areas with weak or non-existent telecommunications infrastructure.

The project team is multidisciplinary, with expertise in Robotics, Electronics, Wireless Communication, and Applied Technological Education, bringing together members from CI-IPLuso (LIC) and the School of Engineering and Technologies (EET) of IPLuso. In addition to the principal investigator, the team includes an undergraduate student from the Bachelor's in Automation and Computer Systems and a master's student to be selected.

Expected outcomes include: the publication of at least four technical or scientific papers, the organization of a workshop, and the creation of an open-source repository with the developed prototypes. The project will also contribute to other ongoing R&D activities, serving as a foundation for future applications to competitive funding.

Alignment with SDGs:

The LoRaMAR project aligns with the United Nations Sustainable Development Goals by contributing to SDG 14 – Life Below Water, through the development of low-cost robotic systems for environmental monitoring in aquatic and coastal ecosystems. By enabling real-time data collection in remote and underserved areas, the project also supports SDG 13 – Climate Action, providing technological tools to better understand and respond to climate-related environmental changes. Additionally, the project contributes to SDG 9 – Industry, Innovation and Infrastructure, by promoting resilient, energy-efficient, and decentralized monitoring infrastructures based on autonomous systems and low-power wireless communication.