Alessandro Puglisi

Robots for Nature and Renewables

PhD Candidate - LIRMM

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Personal Research Objectives

Contribute to **marine ecosystem restoration** with underwater robotics. Enhance system **situation awarness** to inspect **renewable energy** plant and **monitor fragile environments** and **species**. Work in an **heterogeneous team**, with a multidisciplinary approach.

Past Project (Master Thesis): Multimodal Limbed Robot

Motion Control and **Manipulability Analysis** of LIMBERO-GRIEEL: a **Multimodal Limbed Robot** for **Unstructured Environments**

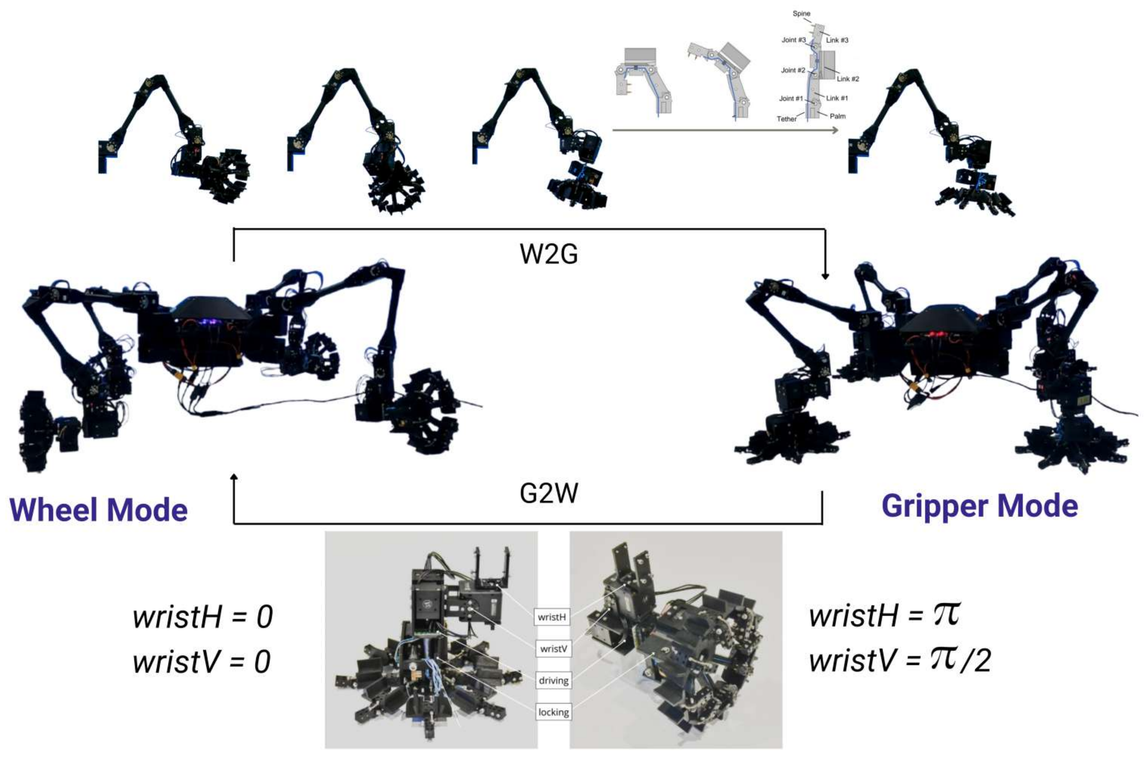


Fig. 1. LIMBERO-GRIEEL (LG).

- Classical mobile robot approach:
  Wheeled for flat terrains
  Legged for rough terrains
- **GRIEEL** = GRIpper + whEEL
  walking + climbing + driving locomotion
- **Exploration** and **manipulation** in complex environments
- **Objectives**:
  - Characterize mobility
  - Set up simulation
  - Define stable transformation

Results

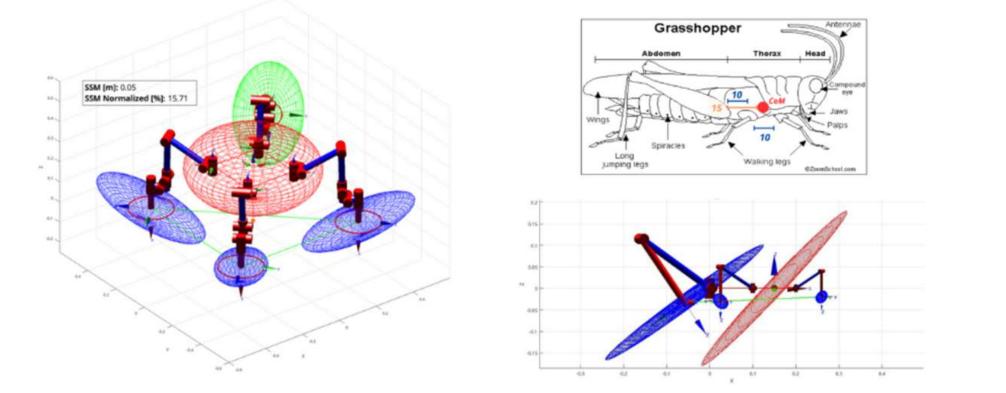


Fig. 2. Manipulability LG(left), bionspired (right).

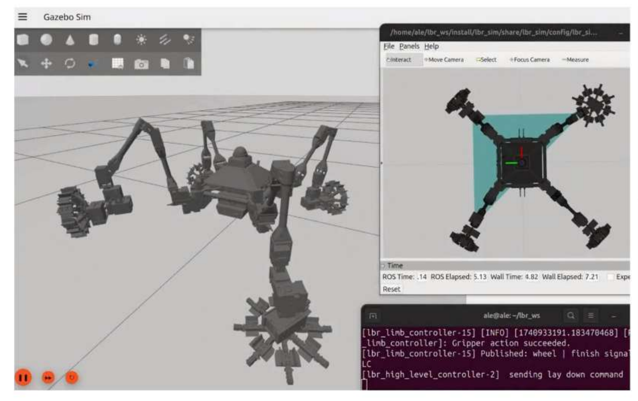


Fig. 3. Simulation.

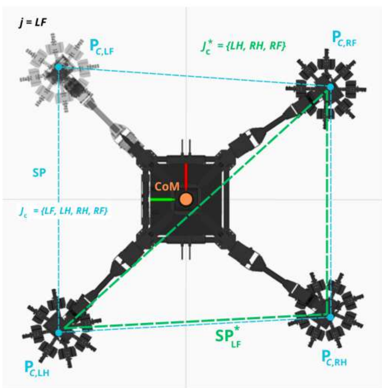


Fig. 4. Transform.

Upcoming Project (PhD): Underwater Robotics for Offshore Wind Farms

1. Upcoming PhD Project: Context

AcoustiBioMap: Mapping and monitoring of the surface condition and biological colonization of submerged parts of offshore wind turbines using acoustic imaging

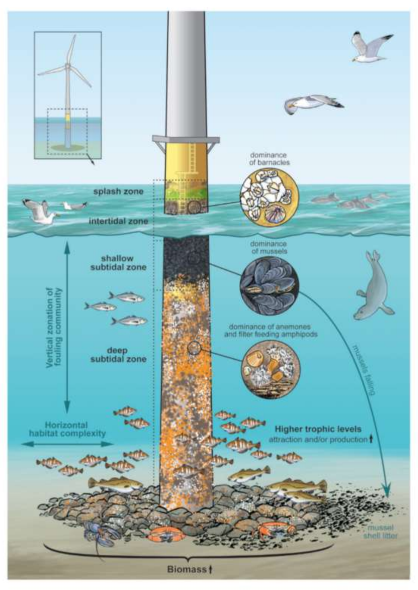


Fig. 5. Reef effect. *[i]*

Fig. 6. OWF. *[ii]*

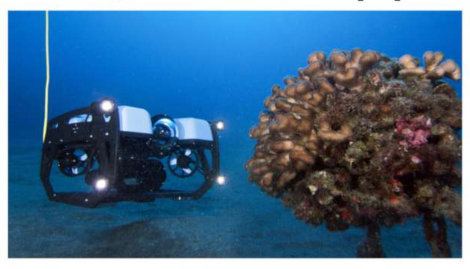


Fig. 7. BlueROV2. *[iii]*

- Offshore wind farm (OWF)
- **Structural damage**, biological colonization and reef effect
- High **maintenance** cost
- **Safety-critical** human task
- Prior structure knowledge
- Observation class **ROV/AUV** Autonomous inspection

Credit: [i] H. Gheerardyn illustration, [ii] Principle power plants, [iii]J. Milisen photo

2. Exteroceptive uw sensors

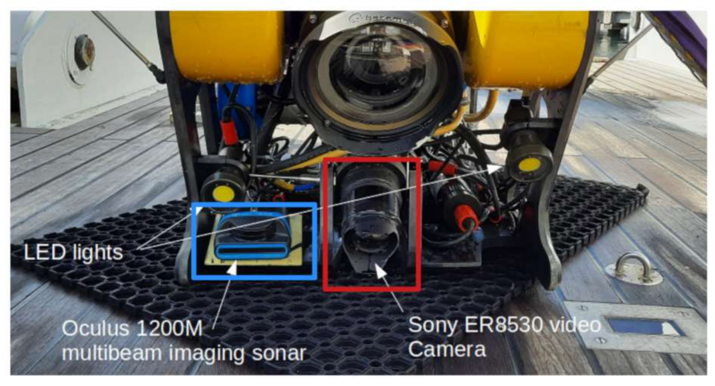
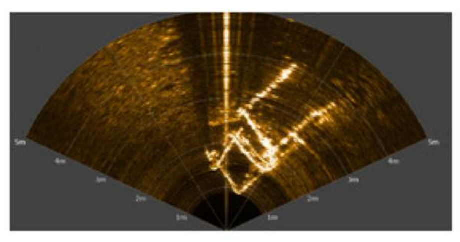


Fig. 8. Sonar-Vision system [1].

Acoustic	Optical
 **Fig. 8a.** Imaging Sonar [1].	 **Fig. 8b.** Camera [1].
• **Not impacted by turbidity** • Long range • Low resolution • **Elevation ambiguity** • No color	• **Impacted by turbidity** • Limited range • High resolution • **Range ambiguity** • Colored images

3. Related works

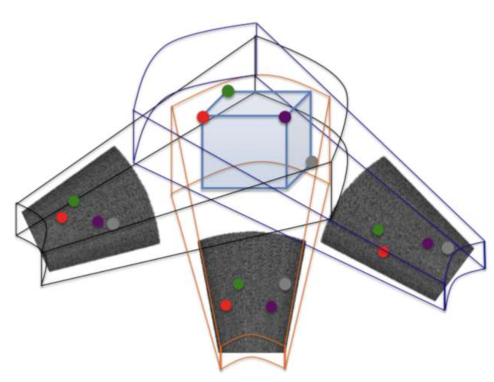


Fig. 9. Acoustic SfM [2]

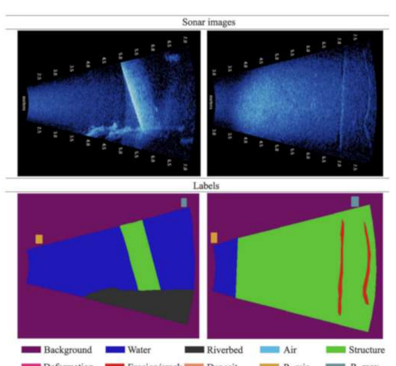


Fig. 10. Segmentation [3]

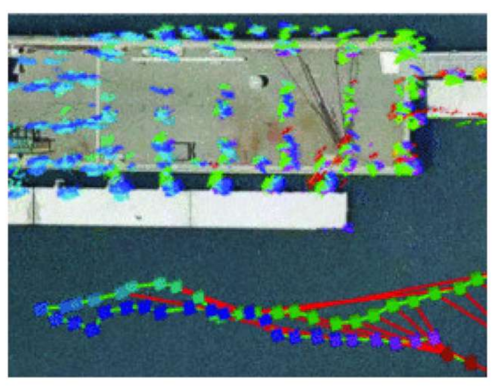


Fig. 11. Predictive map [4]

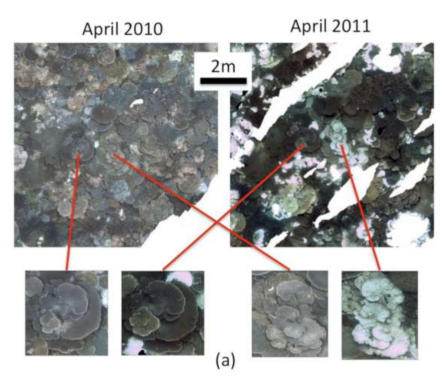
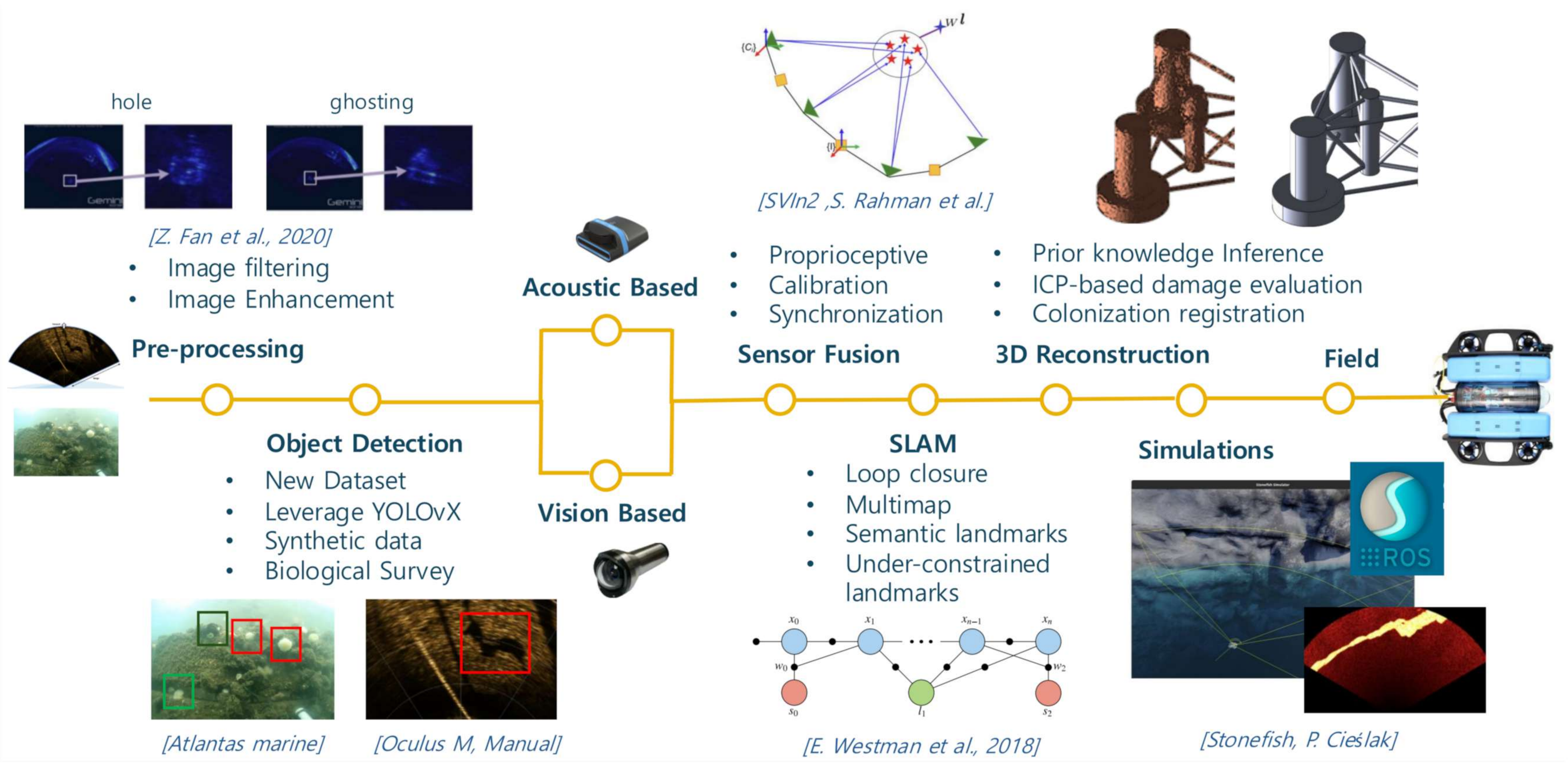


Fig. 12. Spatio-temporal [5]

4. Planned work



References

[1] N. Pecheux, V. Creuze, F. Comby, and O. Tempier, "Self calibration of a sonar–vision system for underwater vehicles: A new method and a dataset," *Sensors*, vol. 23, no. 3, 2023.

[2] T. A. Huang and M. Kaess, "Towards acoustic structure from motion for imaging sonar," in *IROS 2015*, pp. 758–765, 2015.

[3] H. Tan, L. Zheng, C. Ma, Y. Xu, and Y. Sun, "Deep learning-assisted high-resolution sonar detection of local damage in underwater structures," *Automation in Construction*, vol. 164, p. 105479, 2024.

[4] J. McConnell and B. Englot, "Predictive 3D sonar mapping of underwater environments via object-specific bayesian inference," in *ICRA 2021*, pp. 6761–6767, IEEE, 2021.

[5] M. Bryson, M. Johnson-Roberson, O. Pizarro, and S. Williams, "Automated registration for multi-year robotic surveys of marine benthic habitats," in *2013 IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp. 3344–3349, 2013.