



# Multi-modal SLAM Integration and Optimization for an Industrial Mobile Robot

**Abstract:** This project is in collaboration with Adigo Mechatronics and aims to deploy and optimize multi-modal (LiDAR, Vision, IMU) Simultaneous Localization And Mapping (SLAM) on one of the company's robot. The project further considers (for the thesis period) the extension to include the onboard marsupial integration of a flying robot by the Adigo system.

## Tasks:

- Study and understand multi-modal localization and mapping systems, especially those being LiDAR-centric.
- Understand the code base provided by the Autonomous Robots Lab.
- Deploy the baseline code on Adigo rover (or initially on data from it) and assess areas of improvement.
- Develop algorithmic improvements for multi-modal LiDAR-Visual-Inertial SLAM.
- Deploy on the Adigo rover and evaluate the performance.
- (optional/Master Thesis only): Integrate a flying robot of the Autonomous Robots Lab on the Adigo rover and make the two platforms mapping together (i.e., map sharing).



## Literature:

- [1] Khattak, S., Nguyen, H., Mascarich, F., Dang, T. and Alexis, K., 2020, September. Complementary multi-modal sensor fusion for resilient robot pose estimation in subterranean environments. In 2020 International Conference on Unmanned Aircraft Systems (ICUAS) (pp. 1024-1029). IEEE.
- [2] Khedekar, N., Kulkarni, M. and Alexis, K., 2022, October. Mimosa: A multi-modal slam framework for resilient autonomy against sensor degradation. In 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 7153-7159). IEEE..
- [3] Nissov, M., Khedekar, N. and Alexis, K., 2024. Degradation Resilient LiDAR-Radar-Inertial Odometry. arXiv preprint arXiv:2403.05332.
- [4] Ebadi, K., Bernreiter, L., Biggie, H., Catt, G., Chang, Y., Chatterjee, A., Denniston, C.E., Deschênes, S.P., Harlow, K., Khattak, S. and Nogueira, L., et al. 2023. Present and future of slam in extreme environments: The darpa subt challenge. IEEE Transactions on Robotics.

## Relevant Funded Project:

- **Title:** AUTOASSESS
- **Funding Agency:** European Commission (Horizon Europe)

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