EARTH-FIXED TRAJECTORY AND MAP ONLINE ESTIMATION: BUILDING ON GES SENSOR-BASED SLAM FILTERS

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Objective

Navigate an AV in a new environment with no a priori info:
- Obtain a detailed map of the environment.
- Maintain an accurate estimate of the location of the vehicle

I. Idea: Design a two-part algorithm:

Sensor-based SLAM filter [1]
- Filter in the space of sensors – no attitude representation

Earth-fixed Trajectory and Map
- Obtain the pose of the vehicle and a global map

This work is focused on computing the **Earth-fixed** quantities, by defining an optimization problem with closed-form solution, while providing its uncertainty characterization.

*The complete two-part algorithm*
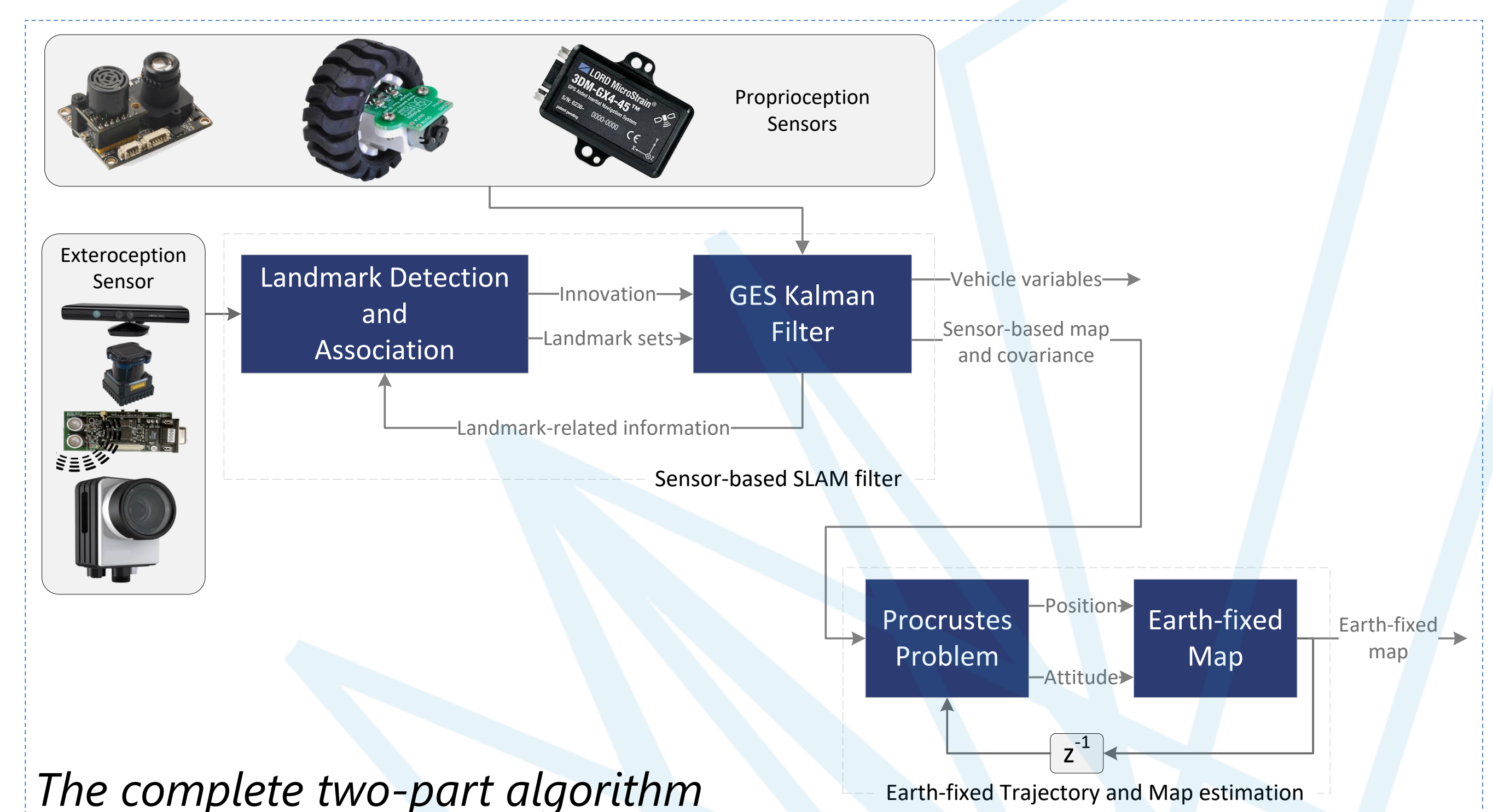
II. What sensors can be used?
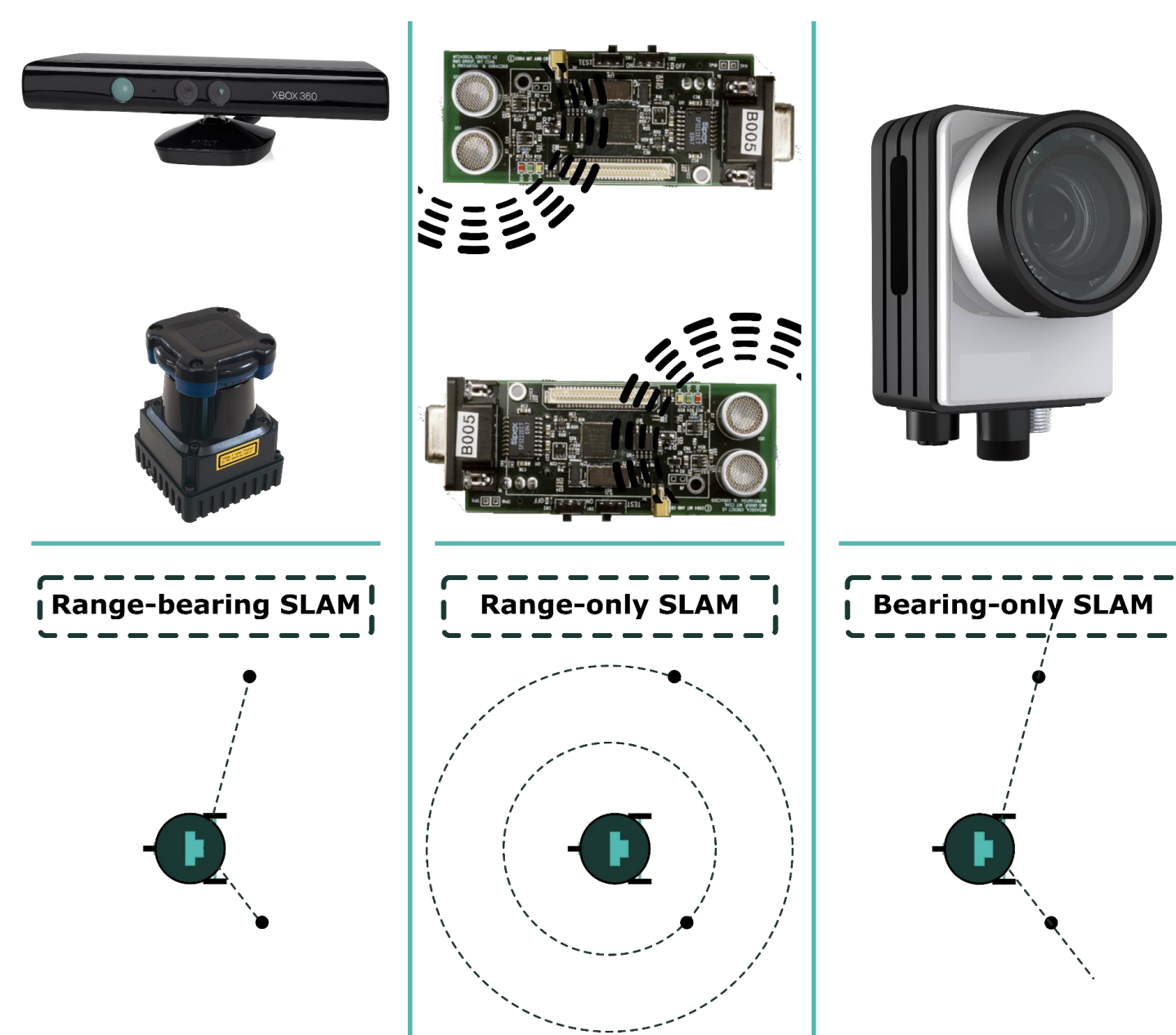
- **Proprioception:** motion sensors, e.g., odometry, rate gyros
- **Exteroception:** cameras, laser range finders, acoustic transceivers

III. Earth-fixed Trajectory and Map

We can compute the Earth-fixed pose if the maps in both frames are available – chicken or egg problem. How can we also compute the Earth-fixed map? It is assumed **constant**!
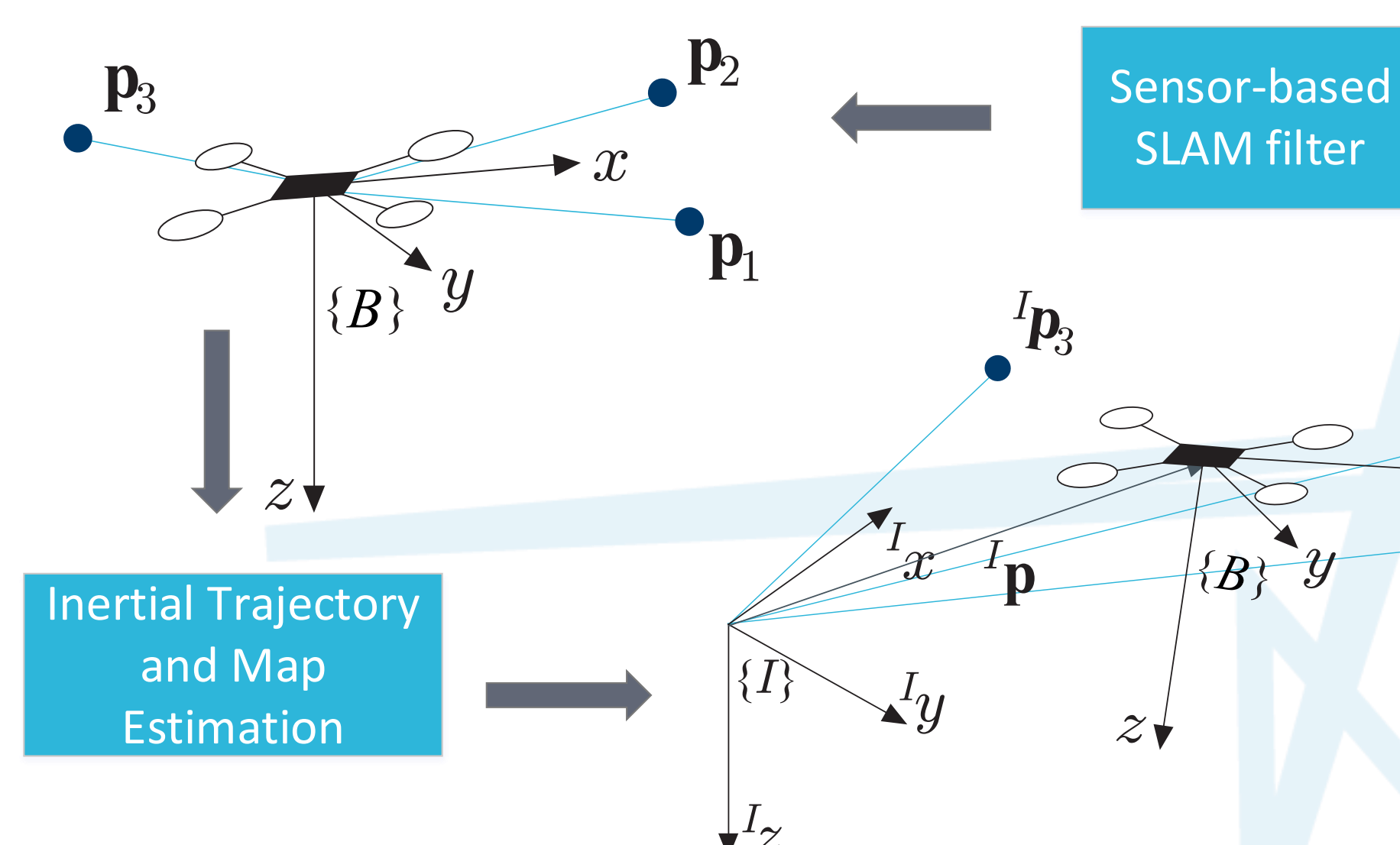
The inertial pose of the vehicle is computed as the solution of an optimization problem, and the inertial map is updated accordingly.

IV. Results

V. Further Reading

[1] P. Lourenço, B. J. Guerreiro, P. Batista, P. Oliveira, and C. Silvestre, "New Design Techniques for Globally Convergent Simultaneous Localization and Mapping: Analysis and Implementation," in Sensing and Control for Autonomous Vehicles: Applications to Land, Water and Air Vehicles, T. I. Fossen, K. Y. Pettersen, and H. Nijmeijer, Eds. Springer, 2017