Thesis Topic: Whisker-based robot localization and mapping

Description of the work

State-of-the-art SLAM algorithms use data from cameras, lidar, or a combination of those. These methods have demonstrated excellent performance, however their efficacy dramatically declines in underground environments that are often dusty, muddy, dark, and locally self-similar. The Centre for Biorobotics has developed a "whisker" sensor and is testing its efficacy in different applications related to robot navigation (references below). In this work, a student will investigate the use of these sensors for Simultaneous Localization and Mapping (SLAM) of a mobile robot.

What will you learn?
- State-of-the-art navigation concepts in simulated and "real-world" scenarios
- Designing and conducting experiments in real-world conditions
- Data processing

Requirements:
- C++ (preferred) or Python 3 skills for development for ROS
- Familiarity with ROS. ROS2 Humble is used, older ROS experience is valued
- Familiarity with sensor fusion and probabilistic algorithms will be helpful

Why is this important?

A robust, low-cost sensor, even at limited range, can greatly improve navigation in unstructured sensory-deprived environments, and significantly increase robot safety.

References:
- Robot's software: https://github.com/Centre-for-Biorobotics/rm3_ros_packages
- Robot's locomotion: https://ieeexplore.ieee.org/abstract/document/10591748
- Whisker-based navigation: https://ieeexplore.ieee.org/document/10610762

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