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SLAM for Highly Dynamic Environments.

ABSTRACT - Masterthesis

In the current technological advancements, mobile robots have played an important role in nurturing innovations in the field of industry, domestic, medical, military, entertainment and space. Recent advances in the field of intelligent and autonomous mobile robots have made the dream come true of utilizing it in real world applications such as planetary exploration, autonomous driving, personal health care as well as search and rescue operations. However, epochal research challenges still remain in the domain of perception. One such research challenge for mobile robot to efficiently localize themselves and to create accurate map of their environment. This is termed as Simultaneous Localization And Mapping (SLAM).

As SLAM aims at building a globally consistent representation of the environment, it has been an active area of research in the past century. Basically SLAM is an appealing mix of geometry, optimization and probabilistic estimation and researchers working on it has to deal with practical aspects ranging from sensor calibration to system integration. Many active SLAM solutions or algorithms have been developed by these researchers to implement it in static environments. These algorithms are available as open-source Robot Operating System (ROS) packages. Gmapping, Frontier Exploration, Karto Mapping and Hector Mapping are some of the notable SLAM algorithms that are available.

This thesis aims to evaluate different SLAM solutions for highly dynamic environments such as warehouses without the requirement of odometry data. The mobile robot employed in this thesis is TurtleBot3 Burger, which is equipped with 360° LIDAR. An extensive experimental evaluation process has also been pro- posed in the built dynamic test environment for the adopted SLAM algorithms with three different dynamic test scenarios. To choose the best algorithm, the performance comparison between the algorithms with respect to accuracy comparison between generated maps and the real-time environment is considered. For the best performing algorithm (Hector Mapping), a more extensive test has been done with more individual components been modified or optimized. At the end, the evaluation of the optimized SLAM solution in the dynamic test environment is also carried out.