Improved Localization and Mapping for Miniature Aerial Vehicle (MAV)

Burak Yücesoy, Brian MacAllister, Maxim Likhachev

Abstract

The purpose of project is to improve localization for a small rotorcraft (hexacopter) over a previous implementation and generate a 3D map of the sensed terrain.

Hexacopter

For this purpose, Hector SLAM package is modified to work on different height levels. ROS packages are also implemented to generate 3D point cloud working with Hector SLAM.

At current state, we are able to localize the MAV in 3D environments and generate map of the environment

Problem

The hexacopter uses existing hector_slam package through ROS. It provides good localization and mapping in 2D environments, but is not designed to work in 3D. Therefore, it is possible to miss some obstacles and collision free spaces.

Solution

To be able to create better plans, we decided to use 3D map. However, instead of directly performing 3D SLAM, we used 2 different components;

- *Layered Hector SLAM* to localize the MAV in multiple heights.
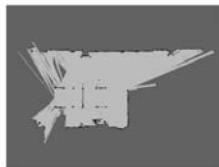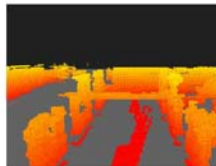

2D Hector SLAM

Layered Hector SLAM

- *Map Builder* to create 3D map using localization info and laser scans on a occupancy grid.

Experiment Setup

3D Map of the Environment

Result

- Localization is improved according do previous implementation with layered SLAM.
- Generated 3D map can be used by other nodes, such as a path planner, to help hexacopter in traversing around obstacles that require a 3D perspective.
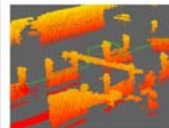
Path Generated by Path Planner using 3D map

MAV is using planned path

References

"Documentation – ROS Wiki." *ROS.org* <http://www.ros.org/wiki/>

Kohlbrecher S., J. Meyer and O. von Stryk and U. Klingauf. "A Flexible and Scalable SLAM System with Full 3D Motion Estimation." *Proc. IEEE International Symposium on Safety, Security and Rescue Robotics (SSRR)* Nov. 2011