Promotionsthema

2018-06-27

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# Change detection for updading IndoorGML models by LiDAR-based SLAM

Along with the advent of SLAM (Simultaneous Localization and Mapping) algorithms, autonomous service robots have been gaining popularity which is justified by the availability of numerous consumer robots such as the Roomba autonomous vacuum cleaner and the Care-O-bot. Such service robots can be used in a range of scenarios such as cleaning, logistics and as assisting systems for disabled persons on wheelchairs.

Indoor map representation and navigation problems have been long addressed by the robotics community in light of autonomous navigation of robots. In this regard, different map representation models have been proposed, such as: feature based maps, semantic maps, point cloud maps and topological maps. It is often the case that algorithms involved in the generation of environment maps are geared towards producing point clouds as end products. A significant challenge with point clouds is that, they do not provide high level understanding of the underlying geometry which could be of great use to infer semantic and topology information which could in turn seamlessly integrate with applications such as BIM.

Higher-level map representation in SLAM approaches, especially in the case of service robotics facilitates semantic understanding and human-robot interaction. Integration with the OGC (Open Geospatial Consortium) Indoor spatial data model standard - IndoorGML could be realized as an implementation of semantically & topologically rich map representation in a SLAM framework. The integration of semantic and topologic information for example in the graph based SLAM framework introduces new challenges and opportunities in implementing optimization algorithms that make use of non-metric information. One such strategy could be the use of convex optimization algo-rithms such as the Simplex algorithm.

The main contribution of the research will be the formulation of a SLAM framework based on high level map representations for indoor environments using the OGC IndoorGML spatial data model. This involves the development of a method to use IndoorGML models for service robot navigation and map representation. Furthermore, the study shall also investigate the use of such high level spatial data models both as priors and posteriors in a SLAM framework along with graph based convex optimization approaches capable of exploiting topological information.