Master Thesis Defense Lakshadeep Naik

Date: Tuesday 30.07.2019
Time: 10:00 h
Room: C130

Title:

Semantic localization and navigation for indoor robots using OpenStreetMap

Abstract:

A significant difference exists between how humans and robots navigate in indoor environments. Indoor robot navigation works at a geometric level in the form of geometric way-points to follow, while human navigation works at a much higher level of abstraction such as go straight for 100 m then turn left at the next junction and so on without relying on the geometric localization estimate.

The goal of this research work is to enable a robot to navigate from one location to another location purely using semantic features present in the indoor environment, without depending on its geometric localization estimate. The robot navigation problem in the indoor environment is divided into environment-specific local navigation tasks. Thus the navigation problem is solved with the execution of these local navigation tasks and switching between them.

One of the main reasons for the significant difference in human and robot navigation is the excellent perception capabilities of humans, which allow understanding the semantics of the environment. However, robots have limited perception capabilities, which makes it challenging for them to understand the environment the same way as humans. This work uses a prior map with rich semantic details to improve robots understanding of the environment.

The main contribution of this work is a proof of concept of semantic localization and navigation for indoor robots using OpenStreetMap as a semantic map. The indoor environment is divided into different types, and semantic localization and local navigation tasks are defined for these environments. All the local navigation tasks use perception-based control, and semantic features are used for localization. Robot perception, the information provided by the route plan and semantic map are used to execute and switch between these local navigation tasks. Individual local navigation tasks were successfully tested on the ROPOD platform while the overall proposed navigation approach was tested in a Gazebo simulator.