Deutsches Zentrum
DLR für Luft- und Raumfahrt

DLR Institut für Robotik und Mechatronik
Münchener Straße 20, D-82234 Weßling

Samantha Stoneman, M.Sc.
08153 28 1980
Samantha.Stoneman@dlr.de

Student Internship or Master Thesis Topic

Dynamic Motion Planning Metrics and Collision Space Formulation for Sensor-Equipped Mobile Robots

State of the art trajectory generation schemes for mobile robots often consider only a dynamic or kinematic model of the robot. In the lab where the environment is known *a priori* or positioning systems such as motion capture cameras are installed, this is sufficient to develop autonomous robots which are able to move around robustly. Outside the lab or in the absence of such positioning equipment, mobile systems need the ability to sense the environment and navigate within it. This typically amounts to determining the robots' own pose the occupied space in it's vicinity using onboard sensors. Onboard position estimation is a diverse research topic in many engineering applications and the choice of particular methods is usually determined by the application design criteria, e.g. resolution and rate requirements and onboard computation limits.

All methods are inherently subject to system noise and error, as well as non-ideal environment conditions. With this in mind, we are investigating the usefulness of including information and/or metrics from onboard sensors in nonlinear optimization-based motion planning algorithms to improve the robustness of mobile systems. As a secondary topic we are also investigating the formulation of discrete environment models such as voxel maps in such planning algorithms and online collision avoidance.

This student position may incorporate:

- Learning the theoretical foundations of path, kinematic and/or dynamic motion planning (books, papers)
- Implementing various sensor-based cost metrics and/or environment model formulations using an existing C++ motion planning library at DLR or external open-source libraries
- Testing various configurations for feasibility and computation time
- Testing in simulation and, if time permitting, experiments using mobile platforms at the DLR such as the hexacopter Ardea (https://www.dlr.de/rm/en/desktopdefault.aspx/tabid-11715/#gallery/29283) or the Lightweight Rover Unit (https://www.dlr.de/rm/en/desktopdefault.aspx/tabid-11431/#gallery/27820)

Contact Samantha Stoneman by email or phone with questions or to apply for this position.