An Odometer-Free Approach for Unmanned Ground-Based Vehicle Simultaneous Localization and Mapping

X. Gu[1, 2], P. Angelov[1, 2], M. A. Khan[1, 2]

[1] Lancaster University, School of Computing and Communications, Lancaster, United Kingdom
[2] Lancaster University, Lancaster Intelligent, Robotic and Autonomous Systems Centre (LIRA), Lancaster, United Kingdom

Content

Simultaneous localization and mapping (SLAM) in unknown GPS-denied environments is a very challenging problem due to the complex environment factors and the lack of prior knowledge of such environments. The performance of standard SLAM methods is dependent on odometer measurements, which, however, are unlikely to be reliable in a challenging operating environment. In this paper, a novel odometer-free approach is introduced for unmanned ground-based vehicle (UGV) to perform SLAM using only LIDAR/SONAR scans in the form of discrete point clouds. The proposed odometer-free SLAM (OF-SLAM) approach can precisely align successive sensor scans without involving other auxiliary information, e.g., odometer readings. By converting the accurately aligned point clouds into continuous local grid maps using kernel tricks, OF-SLAM creates a dynamically updating global map of the surrounding environment and further accurately localizes the UGV on the map. Simulation experiments verify the validity and effectiveness of OF-SLAM and demonstrate the proposed approach as an attractive alternative for UGV to perform SLAM and explore complex unknown environments.