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# EFFECTIVE VERIFICATION SCHEME FOR PLANETARY ROVER LOCALIZATION METHOD UTILIZING LUNAR SIMULANT ENVIRONMENT

**Abstract**

There are many on-going planetary rover projects and most of them require the autonomous driving and continuous observations. The localization system, which is the most important function for autonomous driving, must maintain reliable performance under various environmental conditions. For localization verification under lunar environment, significant differences from the on-ground application appear in applied environments such as diverse terrain, ground conditions, and light intensities, especially, this paper focuses on slippery environment with light intensities variations, and few distinguishable features. We propose suitable localization system to apply the lunar environments by combining multiple sensors data and switching localization methods depending on the environmental conditions. The proposed system's functions are verified step by step considering the characteristics of the functions. This paper introduces the proposed localization system and verification plans and results including lunar simulant analysis and experiment data. To overcome the light intensity variations, we propose switching-SLAM(Simultaneous Localization and Mapping) system utilizing visible and infrared imagers switch the active data sources depending on the light intensity condition. The visible imager and visual SLAM is selected during bright environment and infrared imager and depth SLAM is selected in dark environment. The light intensity sensor data is used as the switch trigger for their methods and the threshold is evaluated via experimental demonstration together with the continuity of the localization. Here, the endurance for the few distinguishable feature environment is evaluated via lunar surface simulation images, and parameter tuning for the SLAM methods. In addition, we propose data fusion system of the SLAM and wheel odometry to compensate the SLAM localization frequency or in case of localization failure. This function's verification is performed utilizing the demonstration with ideal surface conditions and slippery lunar simulant environmental demonstration. Finally, we verify the whole system under a simulated lunar environment. These results must be useful for further discussion of the localization rover system.