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DEVELOPMENT AND VALIDATION OF ROBUST CONTROL SOFTWARE FOR LUNAR AND DEEP SPACE MISSIONS

Abstract

Amidst the Artemis Accord and the pursuit of lunar and deep space exploration, scientists and engineers are diligently engaged in the swift advancement of resilient and autonomous systems. The need for autonomous systems, especially in rovers, is indispensable for lunar and deep space missions, thus ensuring that the algorithms used in these systems are robust is vital. Research on developing various algorithms and software to achieve different levels of autonomy has been ongoing. This study proposes an autonomous control software that can be used in rovers. This software aims to provide robust and comprehensive autonomy for real-time navigation, obstacle detection, and terrain analysis for a flexible and adaptable rover in a harsh environment like the moon. To demonstrate the functionality of the proposed software, a prototype was developed utilizing a Raspberry Pi board and a commercial camera. The developed autonomous models were trained using raw images. The prototype was tested in a simulated moon environment to simulate the lunar surface with its obstacles to obtain the desired results. The proposed software showed promising results by successfully identifying obstacles and optimal route navigation. The proposed software demonstrated encouraging outcomes by accurately identifying obstacles and determining the best paths for navigation. With an accuracy rate of more than 90%, these findings highlight the software's effectiveness and reliability in complex environments.