Paper ID: 95143
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Ms. Cristina Pérez Ramos
Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

TESTING ENVIRONMENTS FOR VISION-BASED SYSTEMS ON THE LUNAR SURFACE: AUTONOMOUS NAVIGATION USING NATURAL LANDMARKS COMBINING VIRTUAL ENVIRONMENTS AND ANALOGUE FIELD TESTS.

Abstract

Autonomous navigation in unexplored environments, such as the lunar surface, represents a significant challenge, particularly in the efficient selection and use of natural landmarks for localization. Compared to navigation systems based on predefined objects, the identification and use of stable natural features, such as craters, rocks, and the horizon line, require advanced approaches that allow rovers to learn and differentiate these features in real time. This problem is further complicated by the impossibility of in-situ testing on the Moon, so engineers rely on simulations, test facilities, and lunar analogs to develop reliable autonomous systems.

In this paper, we present an approach for autonomous navigation on the Moon that uses natural landmarks with feature matching and detection techniques. Initially, given the lack of test facilities in Mexico, we have used a simulated lunar environment in ROS Gazebo to validate our experiments.

In addition, we discussed the construction of a lunar analog environment that will serve as an accessible platform to design, test, and evaluate computer vision-based navigation systems under controlled conditions, replicating key lunar surface features such as craters, rocky areas, and flat surfaces. By providing a controlled and realistic test facility, this environment will not only facilitate the development of our autonomous navigation technique guided by natural landmarks but will also provide a valuable tool for academic institutions in Mexico and other regions seeking to advance autonomous lunar exploration.

The results of this research are expected to provide guidance for the use of feature matching and detection techniques, as well as a set of lessons learned regarding the validation of vision-based navigation systems in an analog environment for future lunar exploration vehicles.