SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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VISONE: MATURING THE LUNAR VISION-BASED ABSOLUTE NAVIGATION TECHNOLOGY

Abstract

During ESA-LL-B1 activities, the necessity of Vision Based Absolute Navigation technology has been remarked as fundamental in order to achieve pin-point automated lunar landing. The maturation of the technology is the essential issue required for acquiring confidence in this innovative and crucial navigation system for achieving precision landing. The solution proposed in VisOne is the heritage of the well-known GMV ANTARES system; the system has been previously chosen as alternative Absolute Navigation Technology in the ESA-LL-B1 phase. Thanks to its high-performance crater detection method, the possibility of creating database from DEMs and ortho-images from past lunar mission and its demonstrated performances and robustness to illumination conditions, Line of Sight changes and Camera model errors, ANTARES is a reliable candidate to go ahead in the development/validation chain for becoming the key component for future lunar missions. The final step in the validation of Visual-based Absolute Navigation technology is, of course, to reach the “flight proven” status before being implied in the GNC closed loop chain of real mission. Obviously, in order to reach this status (TRL-8), various intermediate steps need to be performed. Within this vision, GMV-Rumania has been awarded by the Romanian Space Agency (ROSA) a contract under the national STAR programme deveote to make the ANTARES system generic and reliable for any lunar mission scenario (either orbital or landing scenarios). In VisOne, the main focus is placed in making the ANTARES system suitable for future Vision Based Navigation Experiment to be mounted as payload in future lunar missions. The Roscosmos Luna-Resource mission scenario is used as example/target to verify the flexibility of the resulting system. The paper summarizes the results obtained during the VisOne activity. During the activity, the bread-boarding of the on-board modules of the ANTARES system are completed, validated and benchmarked in a LEON-3 processor. Furthermore, the vision based system is tested in two different laboratory environments. In the first laboratory environment, the Camera hardware is inserted in the Vision Navigation Loop. Comparing results with images previously tested, the experiment allows measuring the influence of the presence of the real camera in the navigation performance. In the second experiment, the system is tested in a laboratory with a robotic arm moving above a realistic lunar surface mock-up. Within this experiment, the results are compared with simulation environment representing the same surface allowing to addressing the influence of environment uncertainties.