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NEMO: AN ADVANCED CROSS-APPLICATION VISION-BASED GNC SW PLATFORM AND SIMULATOR

Abstract

An important feature of vision-based Guidance, Navigation and Control (GNC) algorithms for both space vehicles (e.g. planetary landers) and terrestrial aerial vehicles (e.g. Unmanned Aerial Vehicles, UAV) is the possibility to have a high commonality level across different applications. Consequently, it can be efficient to develop a multi-mission GNC system, which could be used not exclusively in space missions, but also in terrestrial ones, especially in GPS-less environments. The "NEMO" system, currently under development at CGS, in collaboration with the University of Perugia, is an example of such a concept; the project has been conceived by considering the GNC requirements in four different scenarios: two "space missions" (Mars and Moon precision landing and hazard avoidance) and two "terrestrial missions" (support for the landing of a manned helicopter in difficult conditions, and autonomous localization and path planning for an UAV for forest fire monitoring). Subsequently, a multimission software platform has been developed, composed of a set of basic GNC SW modules that can be used interchangeably for multiple missions, with minimal adaptations: as an example, the Digital Elevation Model generation block is essentially the same for all the four missions. Together with the basic GNC SW building blocks, also the modules for enabling closed-loop software testing of the system have been developed, in order to have a complementary Simulator Platform that includes modules for terrains generation (for Moon, Mars and Earth) and sensors simulation (for Cameras, LIDAR and IMU).

This paper provides an insight into the activities conducted during NEMO Study, giving a better idea about the developed algorithms, the software platform architecture and modules, the simulator platform and the system assessed performances.

The results of the activity, presented in this paper, show that significant optimization and cross-hybridisation of concepts and algorithms can be obtained, leading to a flexible system for a wide variety of applications, and demonstrate the possibility to share the efforts of GNC technology development carried out in both space and terrestrial application fields.