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SPACE SYSTEMS SYMPOSIUM (D1)
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SWARM OF AUTONOMOUS ROVERS FOR COOPERATIVE PLANETARY EXPLORATION

Abstract

The growing improvements in computational power, miniaturization processes, sensors and robotics technology allow today to realize low cost, small and multi-tasking mobile robotic platforms with high level of artificial intelligence. In addition, the increasing skills of computer vision in the field of 3D scene reconstruction and obstacles localization allow to integrate an efficient and robust multi-vision based navigation system thus supplying learning capacity. This architecture is typical of an autonomous rover i.e. a mobile platform which is able to navigate, to plan and follow a safe path without human remote control. These capabilities are therefore mandatory requirements for space missions like planetary or asteroid exploration. Till now, this type of missions has been characterized by non-cooperative autonomous rovers working in different and quite far areas. The today availability of low-cost autonomous platforms allows to plan missions involving the use of a swarm of cooperative rovers exploring a predefined area of a planet, an asteroid or a comet, with a common target. The logic of cooperation is based on the fact that each member of the swarm shares a set of information that might help the others in their mission.

The paper describes a possible system architecture of a swarm of two small rovers designed, built and tested at the Guidance and Navigation Lab of Università di Roma, "La Sapienza". The goal of the mission is to reach a common and pre-assigned target position - a hypothetic human station - while exploring and analysing the surrounding environment. The coordinates of a localised obstacles are shared with the other member in order to build a common and continuously upgradable map of the environment and a database of available safe paths. The whole architecture of the designed autonomous guidance and vision-based navigation system together with the communication system are presented in details. Characteristics and quantitative figures of the successful test session are also reported.