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Mars Exploration – missions current and future (3A)

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AUTONOMOUS NAVIGATION IN A GPS DENIED ENVIRONMENT. PROJECT MID (MARS INSPECTION DRONE)

Abstract

The interest of science community towards planet Mars has progressively increased in past decades. Rovers are already doing a great job in discovering the hidden Martian environment and showed us that the red planet is not suited for life. However, there are some hopes to survive by taking shelter in Martian lava tubes that can serve as a shield for radiation and dust storms. These tubes are extremely hard to explore with rovers, and a flying vehicle will be more suitable for such tasks. INGENUITY (Martian helicopter) did a great job in demonstrating that it is possible to fly on Mars by doing small and simple manoeuvres. Based on NASA's design, this article will introduce you in development of guidance, navigation, and control operations of a Martian Inspection Drone (MID) that will be capable of finding the lava tube and scan it in real time using a real-sense camera. Linux based system was chosen in the development process, that allow ROS catkin workspace to connect Ardupilot and Gazebo. The navigation is accomplished using a combination of an inertial measurement unit, a small camera, and a laser rangefinder. The flight computer runs an optical flow algorithm for control and navigation purpose. Also, a convolutional neural network is used to perform lava tube entrance detection and inspection. In addition, MID will be equipped with a real-sense camera that will allow the scanning process in the interior of the lava tube, based on all this data the flight computer will make further decisions and exploration. This part is in still in development and may suffer some updates.