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POLIMI OPTICAL SENSOR FOR SPACE SURVEILLANCE AND TRACKING

Abstract

Near-Earth space has become progressively more crowded in active satellites, inactive spacecraft and debris. Consequently, an international effort is currently being devoted to enhancing the available networks of sensors for space objects monitoring. Within this framework, the Department of Aerospace Science and Technology of Politecnico di Milano (Milano, Italy), in collaboration with the Italian Space Agency, is setting up a new optical sensor. The sensor will be located in the Centre for SpaceGeodesy of ASI in Matera (Italy) and will be fully robotic and remotely operable. The sensor features an optical tube with a focal length of 620mm and an aperture of 280mm, providing an f-number equal to f/2.2. The tube is coupled with a cooled 4/3" CMOS detector, with a diagonal of 21.9mm and a resolution of 16 megapixels. The resulting field of view is $98x74arcsec^2$. The optical tube is installed on an equatorial fork mount equipped with stepper motors and encoders that grants high precision in angular positioning and excellent response to stopping and starting. The mount has a maximum slewing speed of 4 deg/s, with positioning resolution of $0.1arcsec^2$. The sensors is then interfaced with an embedded processor board that runs a tailored version of the Linux OS to control both the mount and the camera using the INDI protocol and exposing them to the network. Therefore the telescope can be controlled remotely by any computer on the network which uses one of the many available planetarium software capable of interfacing with the INDI protocol. This architecture allows remote access to the telescope for direct control independently on the OS used to execute the planetarium software. Moreover, this opens up the possibility to develop ad-hoc software for the automation of the operations. In addition, the system will be endowed with the ability to automatically process the images, and to perform astrometry and orbit determination. The aim of the sensor is twofold. First of all, it will contribute to space objects monitoring by observing objects from available catalogues and performing orbit determination refinement. In addition, it will be used as test bed for the development of new observation and operation strategies, with the ultimate goal of promoting autonomy in observation planning and optical telescopes operation. To this aim, as a first step, the team is working on the development of a strategy to automatically track uncatalogued space objects.