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SOFTWARE FOR SPACE-BASED OPTICAL OBSERVATION SYSTEM

Abstract

As a result of space activity, many objects remain in orbit after mission completion. Inoperative satellites, spent upper stages, parts generated by explosions, collisions or other space activities now populate the space environment, becoming a threat to newly launched and operative satellites. More than 30 years ago scientists like Kessler theorized the possibility of catastrophic collisions, as we see in these years, in space due to orbit overcrowding. Different mathematical models have been developed in order to forecast how the population of debris will evolve in the future. To validate models for space debris global orbit predictions and for the management of close approaches involving operative satellites and the evaluation of appropriate collision avoidance orbital maneuvers, it is necessary to have up to date measurements of the overall debris population and of single objects. A space based observation system can have many advantages. It can permit the identification of smaller objects and outside the atmosphere is possible to obtain clearer images and more accurate results. Particular orbits allow the optimization of the observation geometry and using an appropriate observation strategy it is possible to have continuous observation on determinate orbital regimes. Moreover the system can be used as star mapper, with "bonus" information about the space debris. In the paper it is shown the development of software designed to work directly onboard microsatellites, able to detect a space object and locate it in the sky solving the star field. The software use the Canny edge detector algorithm to recognize the debris. If there is a detection, the stars in the picture are extracted and using and internal solve engine is able to solve the star filed. The solver work with the typical triangle pattern recognition and with a triangle index of the whole sky calculated previously. The software can work with or without a priori pointing information. Main algorithm, preliminary results and software performance in actual observation campaigns are discussed in the paper. The software is able to work on very different hardware, from server to low power microprocessor. This feature allows it to be used directly on board a microsatellite and also in already existing space mapper. In order to calculate what kind of performance it is possible to obtain, simulations have been made with the PROOF 2009. The scenarios simulated ranging from the use of cubsat star tracker to a dedicated satellites to protect specific orbit.