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SYSTEM DESIGN AND ANALYSIS OF CUBESAT FOR ACTIVE DEBRIS REMOVAL IN LEO USING ARTIFICIAL SWARM INTELLIGENCE

Abstract

The increment of space programs inevitably creates enormous space junks in the Low earth orbit (LEO). So, an effective debris removal method is required to solve this issue. As Space debris poses a potential threat to the safety of the missions, it is, therefore, necessary to eliminate them.

An affordable and adaptive solution to address the problem becomes a need at the moment. This research paper assesses an active debris removal method utilizing artificial swarm intelligence-assisted CubeSats that enables autonomous rendezvous with space debris in LEO by capturing and deorbiting it.

The dimensions and the physical structure of the target get identified using the Artificial Intelligence (A.I) method employed in the CubeSat. As the CubeSats function with artificial swarm intelligence, this aids them in autonomously maneuvering around the debris to form a pattern to tether them. This debris removal model differs individually for each space debris object pursued.

This paper studies the technical elements such as the mathematical model of the Artificial Intelligence technology used for target acquisition, efficient orbit maneuvering, and deorbiting the target. In addition, the mechanical model that allows tethering without creating additional debris, the electrical system design of the CubeSats, and the economic viability of the concept were discussed in this paper.

Keywords: CubeSat, swarm robots, LEO, space debris, active debris removal, artificial intelligence, mission autonomy