20th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations - 20th IAA SYMPOSIUM ON SPACE DEBRIS (IP)

Author: Mr. Naveen Rajamanickam
Spaceonova, India

Ms. Nafisa Zian Imam Shafi
Spaceonova, India
Ms. Pallabi Das
Spaceonova, India
Ms. Jeyasiona M.J
Indian Institute of Technology Kharagpur, India
Ms. Supuni Kaveendya Kirimamuni
Samara National Research University (Samara University), Russian Federation
Mr. Sumedh Deshpande
Spaceonova, India
Ms. Uma Parvathi M M
Spaceonova, India
Mrs. Indra Muthuvijayan
Spaceonova, Luxembourg
Ms. Karthika Rani Ramdoss
Spaceonova, India

CLEANING LARGE AND MEDIUM SIZED SPACE DEBRIS WITH ROBOTS USING SWARM INTELLIGENCE

Abstract

Everyday functions in human life like navigation, remote sensing, weather forecasts, etc. depend on satellite infrastructure. Along with this, our understanding of the science of life and the universe also depends on a variety of observation tools that are in space. However, with the large amount of unwanted manmade objects in space, all this infrastructure is at threat. The number of space missions being launched every year are increasing, which will result in more space debris in the earth's orbit. As per recent estimates, there are over 26,000 large and medium sized space debris in various earth orbits. Risks of large debris particles colliding with each other or with working satellites also exist, which may result in an exponential increase of debris particles overall. If a solution to remove them is not found, this problem will increase in the future. The solution proposed here is to use a small swarm of robots sent to space that moves this space junk, which includes end-of-life satellites and break-away stages and components from old missions. These particles will be moved to the graveyard orbit with the help of the intelligent swarm of robots without affecting other satellites. These swarms of robots can be maneuvered to the desired coordinates by using solar energy to power the mini ion thrusters as they are just about three times the size of a typical CubeSat. Swarm AI technology and sensor fusion can be used to detect the space debris and move it to the graveyard zone or to the atmosphere re-entry trajectory which eliminates medium sized debris by burning. By clearing the larger and medium sized debris, the risk of creating smaller debris by collision can be reduced. This solution proposes the detection of debris by analyzing sensor data with the help of artificial intelligence. Further, a swarm intelligence model can be used by the robots to coordinate among themselves and move the space debris to the desired location. In future

iterations, a complete design and more features can be added to make it more efficient. In this paper we will focus on the space debris detection model and swarm intelligence algorithm for large and medium sized space debris removal.