

# OCTA X – Analysis and Extermination of Space Debris

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**Abstract-** As we are heading towards the age of communication and advanced space exploration for the betterment of life and in the search for life on other planets in the universe. As we head towards the age of this modernisation spacecraft and satellites are being launched into free space as well as into the orbit of the earth and other planets too, for various purposes, as all machines have a life cycle so do the spacecraft and satellites have, as we know the fundamental law that material can't be created nor be destroyed so, all the junk satellites and spacecraft just revolve around the orbit or in the free space creating the junk debris of the dead spacecraft which causes functional difficulties for the other space operations for the other spacecraft. Day by Day the problem is increasing and creating a major concern of the junk that envelops the planet hence creating hindrances for further space missions. And by OCTA-X is a robotic octopus-shaped debris cleaner and eliminator, the robotic AI Arms have big claws with a big cavity that can collect junk material and suck inside the main body of the robot, pack it throws it in the direction of the star (sun) which will culminate the junk material, hence cleaning the space debris with help of an AI Octopus Shaped Robot.

**Keywords-** Eliminating, Deorbit from earth orbit, AI Octa handed robot, extermination, electromagnetic catapult.

## I. INTRODUCTION

OCTA-X is a robotic octopus-shaped debris cleaner and eliminator, the robotic AI Arms have big claws with a big cavity that can collect junk material and suck it inside the main body of the robot, pack it throws or deorbit from the earth and orbit it in the direction of the star (sun) which will culminate the junk material, hence cleaning the space debris with help of an AI Octopus Shaped Robot.

Most of the satellites and spacecraft are made up of light and strengthened materials like **titanium and aluminium**. Additionally, they'll use composites and alloys, such as nickel-cadmium or aluminium-beryllium. Most of the Space debris is found in **low Earth orbit**, within 2,000 km (1,200 miles) of Earth's surface, though some debris can be found in geostationary orbit 35,786 km (22,236 miles) above the Equator, which is a major risk for the spacecraft for their functional and exploration related operations and can even a threat to the other spacecraft and even for the planet relating to its climate and geographical conditions on the planet indirectly. Although the density of space debris is now so great that astronomical observations are often degraded by it.

The main problem is that of collisions with operational spacecraft. Spacedebris impacts Earth's environment and atmosphere by releasing compositional chemicals into the atmosphere when they burn up upon re-entry. These chemicals can deplete ozone, and the debris also poses a threat to future launches and space exploration. So, it's very important to remove space junk from orbit and

culminates them to prevent any mishappening with other spacecraft or satellite, so far this OCTA X can be very effective in removing and culminating space junk, as it has eight robotic arms with large bowl-shaped claws that can effectively collect the junk as this robot is AI-powered that can sense the direction, velocity and orbit of the junk and can adjust itself with space junk to catch it and the claws has a suction mechanism which will suck the material and collect it in the processing chamber where all this junk will pack in high graded nets and throw them or release it towards the sun where on reaching or colling with the sun will destroy them.

There will be an electromagnetic catapult installed in it which will throw the package of debris collected through the eight arms of the robot. This catapult will also help in the mobility of the spacecraft in orbit and free space, with this technique the robot; can change the orbits between polar and geostationary. Hence this way can be effective in cleaning space debris or space junk and preventing the various kinds of possibilities of negative effects of the junk on the earth and other working space operations.

## II. APPLICATIONS

- The said robots have multiple applications as this ai robot does not only remove or deorbit the debris or the junk material from earth's orbit but also exterminates it by throwing it with a high velocity towards the sun in free space and ultimately the gravitational pull of the sun will attract the package towards it and destroy it because of the high temperature of the sun.

- The robot also serves as a satellite with multiple applications and devices installed in it.
- The main advantage of this robot is that it can interchange the orbit between polar and geostationary.
- The electromagnetic catapult installed in it can not only throw the junk material but also helps the spacecraft to change or move between the orbits.

### III. ANALYSIS OF THE SPACE DEBRIS

The space debris population is the same as that of the asteroid belt of Saturn however, this is subjected to high-velocity moving particles colliding with each other and contributing towards the variation of the sizes of the particles of the junk material and its distribution. Currently, more than 10000 particles above the size of 10 cm are orbiting the earth at very high velocity and more than 300 000 are 1cm diameter particles orbiting the earth. All the objects contributing to the space junk are made up of different materials and compositions ranging from high energy fragmentation to large spacecraft to the slow diffusion of the liquid metal. The jeopardy of space junk or artificial space debris is of high threat to the current work and missions related to space exploration.

All the un-classified spacecraft currently in orbit are catalogued by the United States Space Command in the Two-Line Element (TLE) catalogue. In this catalogue, about 10 000 objects and their current orbital parameters are listed. The limiting size of the objects included in the catalogue (due to limitations in sensors power and in observation and data processing procedures) is about 5 to 10 cm below a few thousand km of altitude and about 0.5 - 1 m in higher orbits (up to the geostationary ones).

Most space debris is found above 7000 ft and mostly in the polar orbit of the earth but there is evidence that space junk or artificial space debris orbiting the earth is also in the geostationary orbit and this is the major threat to the existing satellites and spacecraft present in the orbit or crossing the earth's orbit. The overcrowding of space with the space debris around the Earth makes collisions with the existing satellites or spacecraft a serious threat and a very vulnerable environment for the space mission and, as pointed out by the Cerise event, a reality. To prevent damage by space debris with (small debris) ( $\leq 1$  cm) multi-wall bumper shields have been devised and installed on the International Space Station (ISS). Yet, for larger debris, the shields are not enough to prevent the penetration of the target or even its complete fragmentation.

#### 1. Elimination of space debris:

Now space debris is a concerning threat to the existing spacecraft and the satellites orbiting both in the polar or the geostationary orbit. As these are fast-moving, we can say that high velocity orbiting small particles of the artificial debris of the old spacecraft and satellites, there

are now installed extra sheets of tougher materials to protect the spacecraft or the highly complicated aerobatic manoeuvres are followed to prevent the collision or to be safe from the debris bombardment over the spacecraft or the satellites.

The Ai Eight hand robot spacecraft which have to suck and electromagnetic properties with claw clamps to catch the small particles of space junk or artificial space debris, the arms are flexible and can move in any direction as of octopus hands and they will collect all the metal particles through the electromagnetic attraction and the other materials like ceramics and plastic or composites can be cached through the large palm like the structure of the arm in the electromagnetic is also installed which is collecting the metallic particles. After collecting the particles, the particles will be sucked through the arms to the main hub or hull of the spacecraft where they will be packed in a net collectively with the help of Ai enabled mechanical system then with the help of the electromagnetic catapult the package will be thrown towards the direction of the sun where it will be exterminated and by this technique, we'll be eliminating the artificial space debris from the earth's orbit.

#### 2. The Detection and analysing of space debris:

Space debris or the space junk of old satellites and spacecraft is a serious threat to the future, as well as existing satellites and spacecraft so, for the elimination by the Ai spacecraft, is very crucial the detection of space debris as it is scattered in clusters all over the earth, almost in every orbit of the earth, so laser scanning and radar imagery is used for the detection of the space debris by the spacecraft and the Ai system of the spacecraft which will analyse the orbit and coordinates of the artificial space junk and with the help thermal imagery and radar it will also analyse the material of the space debris which will further decide the action of the Octa X arms whether to attract the material using the electromagnet or to catch the material with large gloves or the palm of the hand without using the electromagnetic property or function of the gloves or palm of the hand. The octo Rms or the spacecraft is capable of catching junk made up of any kind of material, metal, nonmetal or ceramics. The spacecraft will attract or catch the artificial space junk through its eight arms and the collected debris will suck through the arms to the central hub where it will be packed in thermal packaging and thrown towards the direction of the sun where the package will be attracted by the gravitational pull of the sun and ultimately destroyed by getting dumped in the sun.

#### 3. The manoeuvre of the Ai spacecraft for the elimination of the spacecraft:

Artificial space debris is scattered all over the earth's orbit almost in possible orbit around the earth, and the overcrowding of space junk is a threatening concern, to catch the space debris moving at a very high velocity the

spacecraft has to match the orbit and velocity of the junk to catch it for those manoeuvres the Ai spacecraft will be using liquid hydrogen-filled thrusters for the manoeuvring in the orbits and for the speeding of the spacecraft the liquid propellant based thermal boosters will be used which will give them enough thrust and speed to match the velocity of the artificial space junk. For the larger descent, the electromagnetic catapult used to throw the junk package can also be used for the large manoeuvre between the large orbits and to save the energy and liquid fuel of the spacecraft.

#### 4. Maintenance and Refuelling of the Octa X Ai spacecraft:

The maintenance of the Ai spacecraft needs the electrical maintenance and refilling of the thermal bags used to pack the space junk and the refuelling of the booster and thrusters for the manoeuvring of the spacecraft between the orbits for catching the space junk and eliminate it.

The thrusters and boosters need the refilling of the liquid hydrogen and oxygen which is very necessary for the movement of the spacecraft and that can be easily done via the International space station (ISS) as the Ai spacecraft will detect the location of the ISS and can easily refuel it and the bags can also be refilled by the crew of the ISS while the attaching sequence and refuelling of the spacecraft are attached to the ISS and the refilling of the thermal bags and all other electronic and electrical maintenance can be done during that period.

#### 5. Energy and Power source of the Octa X Ai Powered Spacecraft:

The Ai spacecraft need an abundant amount of energy to run all eight arms, the electromagnetic catapult and all other operations for catching and eliminating artificial space junk. To perform this operation the spacecraft needs power and the primary source of energy would be solar energy which can be used to directly convert the electrical energy and its utilisation and the secondary source would be the batteries for the supply of power to devices for conducting operations and these batteries could be charged using the solar energy. To trap the solar energy we'll be using the solar panels installed on the spacecraft and the surface of the spacecraft will be enveloped with silicon film or the solar film used in solar panels so, we don't have to use the large solar panels which will occupy the space of the spacecraft and make it heavier.

## IV. CONCLUSION

Space debris is becoming a major threatening concern for all space agencies which is making the external environment vulnerable to the space accident and collisions of satellites and spacecraft the effective way of removal of space debris is a current need of all space agencies, to perform the elimination of the space debris it very important to analyse the structure and nature of the debris and the material of the debris, to detect the orbit and

coordinates of the of space junk and after the detection of the space debris and the analysis of the space debris the effective way of removing or elimination of the space debris is required to protect the existing and future space mission and the satellites.

OCTA -X is the way forward in the effective way of analysing and eliminating artificial space debris or space junk.

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