THE SNAKE: SPACE DEBRIS REMOVAL SYSTEM

New kind of debris removal technique

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Abstract - Space debris is a very serious problem that cannot be solved in it, even in the near future. Unfortunately, most of the proposed methods for space debris collector or removal technology are not successfully functional. Keeping in view the shortcoming of the existing methods for debris removal an active approach is needed in this regard required to be implemented purposefully. We are proposing combining mostly available technologies in a new way for cleaning the space junk. The basic ideas about this proposal method totally depend on feeding technique and expansion body of snake. Even we consider this species anatomy for developing this system. In this paper we are proposing an idea to remove space junks in Low Earth Orbit (LEO).Our target is to capture the larger and small junk which involves materials of size between the ranges 0.4 – 10 feet or may be bigger.

Index Terms - LEO (low earth orbit), Space debris, orbital debris, space junk, defunct satellites, movable gas thruster, extendable bag, snake Anatomy.

I. INTRODUCTION

If we continue to launch more and more satellites, orbital debris is becoming an increasingly larger problem for spacecraft operators. Space debris does not a new problem for scientists, but rather one, like climate change, that has recently come to light due to the increase in the rate of space satellites launches. Humanity has left a significant mark on the space beyond Earth. In more than half a century of space activities, more than 4.8k launches have placed some 60k or more satellites into orbit, among them thousand are still operational today. More than 12k orbiting items in total are regularly tracked by the US Space Surveillance Network and maintained in their catalogue. As per this catalogue right now in space having approximately 5 to 10cm junk /object in low Earth orbit (LEO) and 30cm to 1m junk /object at geostationary altitudes (GEO).

In this debris object like dead spacecraft, lost equipment, boosters and some of other unknown debris in space. As we consider total space object then fragmentation debris (42%) - break ups of satellite, unused fuel, dead batteries, rocket bodies (17%), mission-related debris (19%), and non-functional spacecraft (22%). Only 6% of operational satellites in space .This type of junk threat for working spacecraft or satellite. Some time it hits unmanned/manned spacecraft and damage some part.

As of July 2013 survey, more than 170 million debris smaller than 1 cm (0.4 in), about 670,000 debris 1−10 cm, and around 29,000 larger debris were estimated to be in orbit. As of 5 July 2016, the United States Strategic Command tracked a total of 17,729 artificial objects, including 1,419 operational satellites. In most of case some of satellites are working and other one only just debris.
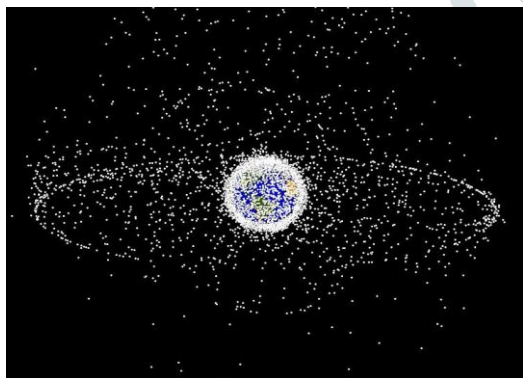

Figure 1 Space debris representation.

So, there are two way to reduce debris: mitigation and removal technique. **Mitigation** refers to reducing the creation of new debris, while **removal** refers to either natural removal by atmospheric drag or active removal by human-made systems. Currently removal system cannot be used because it does not cheaper than mitigation. Most of removal technique have based on active removal technique. There is currently no man-made space debris removal system in operation, nor have there been any serious attempts to develop one. If we want to stable our space environment than we must annually removing as few of these objects will significantly stabilize the future space debris environment.

II. INTRODUCTION OF OUR PROPOSAL

In our project we are going to use junk box which has design as shown in figure. It consists of snake feeding and expanse technique. Snake is long and flexible which allows them to stretch out or to coil up. [2] With the help of this stretch technique. We able to capture any type of junk and extend size as per object with special mechanism. Moving thruster technique also helps for move this system as per required direction. Using camera for see object and door uses for incarceration junk. After capturing it, it will collect the junks in the resizable box and repeat the same process until resizable box is completely full then return back to earth by movable thruster.

III. ROCKET AND PAYLOAD IN ORBIT

Rocket has 3 stages, and each stage is to be dropped as its propellant is consumed.
- The first stage uses a [1A] single powerful engine, and 4 SRB"s.
- Solid rocket boosters (SRB) help the launcher to lift heavier payload.

- At stage one, both the main engine and SRB are ignited at lift off.
- The SRB are jettisoned about 2 - 3 minutes into the flight when their fuel is spent.
- About 8 minutes into the flight the first stage has consumed all its fuel.
- The first stage is jettisoned and the [1B] second stage engine ignites.
- The payload is protected by an aerodynamic fairing inside the atmosphere. This is not needed when the rocket is in space so it is jettisoned.
- About 25 minutes into the flight the second stage has consumed all its fuel and is jettisoned.
- The [1C] third stage is ignited and burns until the correct velocity has been achieved. At this time it is shut down.
- The payload now has enough speed to coast to 500km altitude, the highest point of the flight.
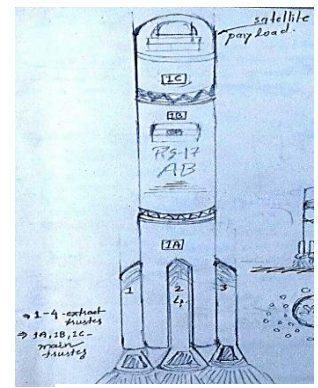- After reach at defined point than fairing will be opened and the payload will be sat down.

Figure 2 Rocket section

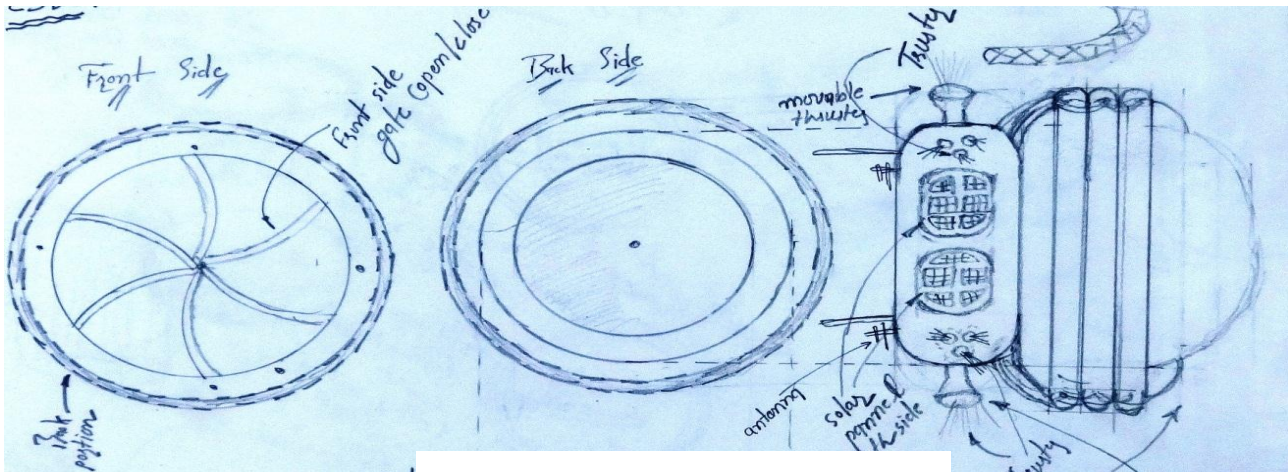## IV. PAYLOAD SECTION.

Figure 3 Payload section.

The payload section of our launch vehicle will carry 2 or 3 junk boxes which are employed for the sake of removing debris in space. Each junk box has solar panel, movable thruster, antenna, camera and many more.

The basic idea to capture the debris is to use movable thruster, extendable bag and door which open and close as per requirement. With the help of movable thruster we can be pushed this system as per capture junk. While junk nearer door will be opened and closed after junk inside this extendable bag. And this collected junk is bring back to earth by using same thruster for push into downward to earth, while it comes into earth atmosphere the front portion totally burned up and remain part separate out. After reach certain level of kilometer parachute will be come out. It will be helped for safe landing of this collectable debris.
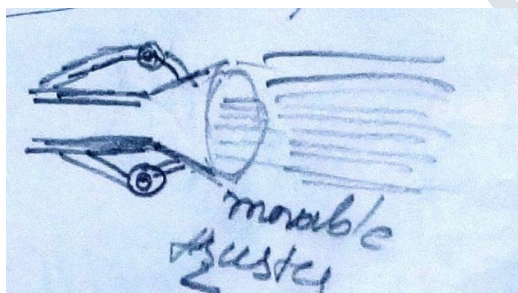
V. MOVABLE GAS THRUSTER.

Figure 4 Movable gas thruster.

These movable thrusters help for move this whole system. Actually solid state hole available at front portion same like any satellite for setting position. Same side here we use this type of gas thruster, which controls by two elevator part. With the help of this part we can move nozzle for particular direction. Here we just sat down some position and movable nozzle throw hydrazine (monopropellant thruster).It pushes satellite at some range for move this structure. This propellant use whenever you want to capture any type of junk or large debris. Otherwise you put this system pre calculated path where debris travel and preprogram for catching small parts/junks. So, you will catch those small junk without doing anything. You can also use this static nozzle for move satellite at complex direction.
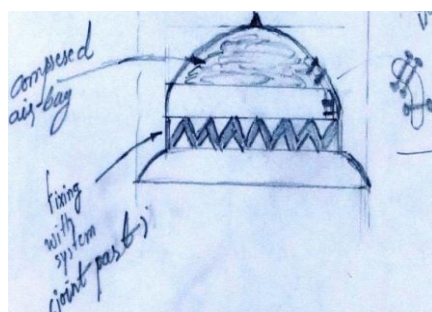
VI. PARACHUTE SECTION.

Without parachute you cannot recover any satellite safely. While you from sky and want to land safely than you need parachute for safe landing. Same concept for this method. This system works separately because of enter time at earth atmosphere front portion totally blow up. So, we must design separate system for recover. So, this section bound with back part for extension bag. After certain kilometer sensor tells situation than back hood will be opened and parachute come out.

Figure 5 parachute section.

VII. EXTENDABLE BAG.

Previously we talked about snake feeding technique and structure. Snake has great ability for sketch their body as per size of food. This type of ability we can use in satellite. Here size of bag extent as per food means junk/part of any section.

Using of this extendable bag section you can collect more and more debris. While launching time and sat position time size of collection section quite very less. After folded portion extend up to some range. You can control this part as per your choices. Initial stage size is to be smaller than increase after collection of junk.
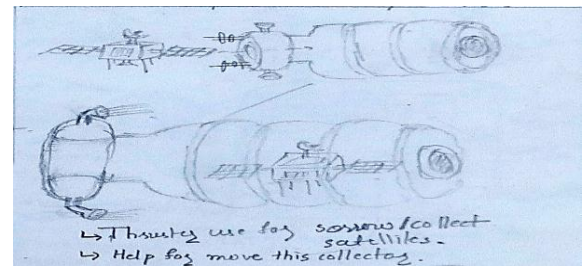

Figure 6 Extendable bag.
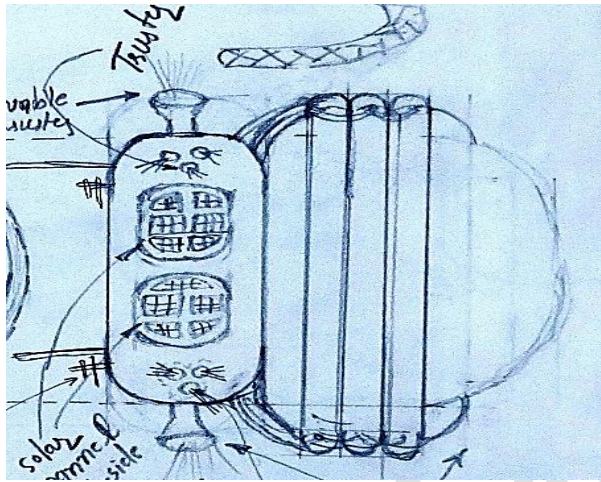
Figure 7 Compressed section
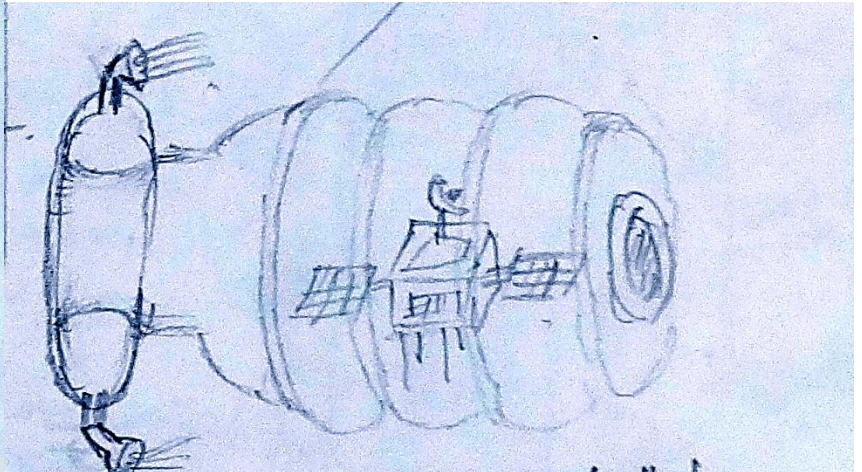
Figure 8 Uncompressed section

As per this two figure you can understand before and after situation for this section. It starches their size same like snake anatomy. Before size is smaller than it extends up to some range. Because this section it's not much powerful like snake. Mechanism is quite simple, whole bag makes from high tensile material and extender frame place for servo motor for moving forward or backward which means compress/decompress sections.

## VIII. HOW WE GOING TO IMPLEMENT THIS METHOD TO CAPTURE SPACE DEBRIS?
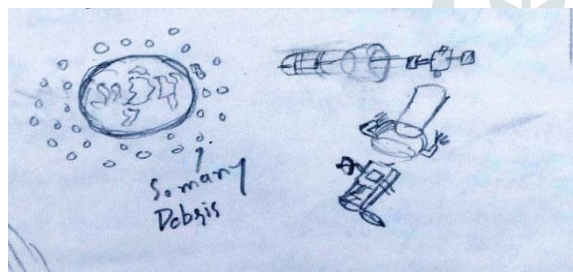
Figure 9 travel this system in space.

Taking the basics of physics, we have developed our method to capture the junks in space. As we know so many debris moving around our earth. So, we all are working on active removal technique. So, this type of technique will be taken upto certain range debris and come back very safely. Main reasons behind this project for collect it and reuse this junk for another project. If we capture this type of big satellite than great for achievement. This method using simple mechanism basically focuses on capturing of space debris like; metals, equipment, satellite (some range) and etc. in Low Earth Orbit (LEO).

By this image, you can understand about this whole situation about lunching and come back with safe landing. After successfully launched this system and start for collect junk until full their extendable bag than gas thrusters helps for push into downward this system from LEO to earth.

It reaches some level of kilometer than parachute will be opened up and this system land on earth very safely. If you calculate path of system and tracking debris than you need to control this system only at collection time. Other condition, while you need point out antenna from ground station than you need to control thruster.
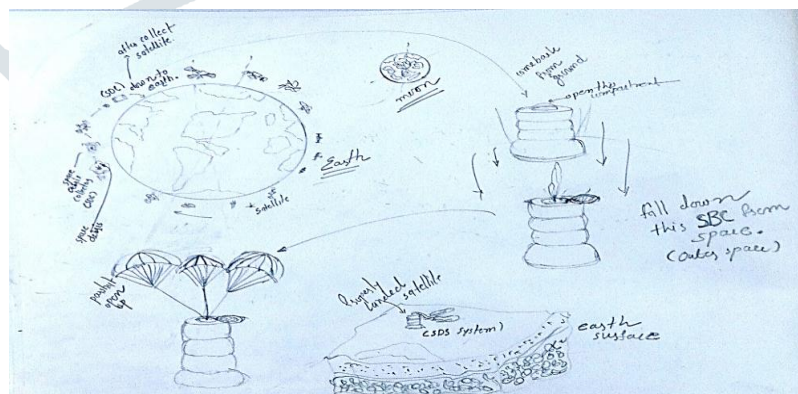
Figure 10 how to work this system?

IX. CONCLUSION.

As space debris is current upmost problem, here we proposed the method to capture the debris which is very efficient method cause it uses fundamental of anatomy of snake species i.e. stretch method or feeding technique of this species. This method is very cost effective method also we are going to use this method available technology for collect the junk and returning it to earth. After doing more work on this project we can employ it practically.

X. ACKNOWLEDGMENT

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