Shared Satellite Ground Station With Cognitive Radio Frequency Using Signal Defined Radio

Application form

Summary

Small-size satellites are seriously in research not only for studying but also supporting the commercial purposes. Because of their small dimensions, it is convenient for the unique tasks such as: relaying signal, local area observing, environmental index measuring… which would down the price of both manufacturing and launching process. Therefore, small-size satellites are more and more be interested in. SVOM projects … launching satellites and

Relating to jobs of satellites mentioned above, they need the system called Satellite Ground Station (SGS) for receiving control signals and communicating. Usually, the host (who has satellite launched) will own or renting one or some system for operating. However, orbit time for satellite does not allow it to link to the SGS all the time. The bigger orbit radius, the longer satellite can contact to its SGS. Most of small-size satellites work in LEO (Low earth orbit) and usually flight over the SGS twice per day.

In the demand of getting signal as comprehensive as possible, people need to distribute SGS around the earth. This is nearly impossible because of boundary of nations and cost for building, operating and maintaining. The group of sharing private SGS seem to be a good solution. Individual owning SGS (so called Host) could join a network of sharing and using SGS. The requirements (bandwidth, rating, durability…) should be established when they join the network. People who wants to get signal from satellites (so called User) could match their requirements to suitable available SGS.

There are lots of rising private company in space (SpaceX, Blue Origin, Sierra Nevada Corporation…) investing more in satellites and space commuting.

The project includes steps

1. Doing comprehensive literature research on space engineering, spacecraft dynamic and satellite communicating.

2. Constructing azimuth and elevation rotational structure. Design and building the mechanical structure of universal-mounting rotary antennas. Figuring out the optimal solution for electrical system and design. Programing a software with graphic user interface helping people to control structure manually and automatically.

3. Observing satellites broadcasting signal using SDR with suitable antenna. The system should adapt with many frequencies

4. Evaluating the performance and accuracy. Comparing with SVOM project if possible.

5. Finalizing and writing report.

Description:

In the step one, we need to do research on previous relating problems to find the similarities for boosting the process. We will evaluate the demand of using SGS based on statistic information of satellites launched or going to be launch about: working frequencies, orbits, communicating and life time. The purpose of job is figuring out which suitable antenna and LNA we should use and economic benefit in the future. We need to understand the basic of spacecraft dynamic for and orbit studying for getting familiar with space positioning.

The work load in step two is very heavy. Firstly, we need to design a suitable structure which could be carry the universal-mount responsibility which means we want to mount as many kind of antenna as possible. The reason is about the cognitive radio will work with many frequencies based on specific purpose, so the antennas must be suitable. The mechanical structure will allow the oriented antenna rotating in both azimuth and elevation axis. Secondly, the system requires appropriate motors and driving system as well as high precision electrical system. To manipulate this rotational system, we need to program a software running on computer to allow it working in both manual and automatic mode. The structure is expected to work outside with wind and rain resistance.

In step three, we will work with SDR kit cat

Timeline

Budget plan

Academic supervisor

Academic research

Appendix