Communication Between Satellites

Chen Ostrovski

August 7, 2021

1 Introduction

This project is a program in Python that will receive two sets of coordinates on Earth and will be able to form communication between them, using the Starlink company satellites. Starlink is a satellite internet constellation being constructed by SpaceX; providing satellite Internet access. Each time the program is run, the satellite locations will be continuously updated via an API, then, it will find the shortest route that passes between the two final sets of coordinates. The program also receives the wanted distance between the satellites: If the distance between the satellites is less than, say 1000 km, they can communicate directly via a laser (constants 1500, 2000 km will also be checked). Satellite communication to ground - we will assume that it depends on the aerial distance between them - again, we will take the constant of 1000 km (between LEO satellite and the ground).

NetworkX, a Python package that was extensively used in this project is mainly intended for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks. With the help of NetworkX and SIMPLEKML we will create a graph that will show the connections between the satellites, either directly via the program's GUI or using the created KML with Google Earth.

2 End Product

The program get wanted distance and two coordinates on Earth as interactive input from the user. Next, it will go over all the satellites in Starlink project and will search for the shortest path between them using the NetworkX library. Finally, the shortest path will be shown in a NetworkX graph alongside a KML file in the projet's root folder that can be used to visualize the path via Google Earth.

Figure 1: The route between two selected coordinates, the first one in Israel and the second in Spain via Google Earth.

3 Google Earth Connection

In order to import our KML file into Google Earth go to the Menu - Projects - Import KML Directly From PC.

4 Academic papers and related projects

Many articles have been written on the subject of communication between satellites which have tried to compare different algorithms and find out which is the best and fastest algorithm. These articles mainly discuss the many problems that communication experts encounter and do not visualize communication. Starlink0031 is a basic connection-level simulator for the SpaceX Starlink network via Unity engine. It simulates routing across a mesh of inter-satellite links and via ground relays.

5 Schedule

To Do	Date
Create new Python project	14/05/2021
Get Starlink Satellites API	18/05/2021
Use the NetworkX to create a graph	05/06/2021
Find the shortest path	17/06/2021
Create KML file to visualize via Google Earth	01/08/2021

6 Requirements

This project has no hardware requirements only software requirements.

- Python 3.0
- Starlink API
- NetworkX library
- SIMPLEKML library

7 GitHub

GitHub