Hochschule Bremen
City University of Applied Sciences

HSB - Satellite Communication
Satellite Tracker App - Manual

Content

1. Introduction

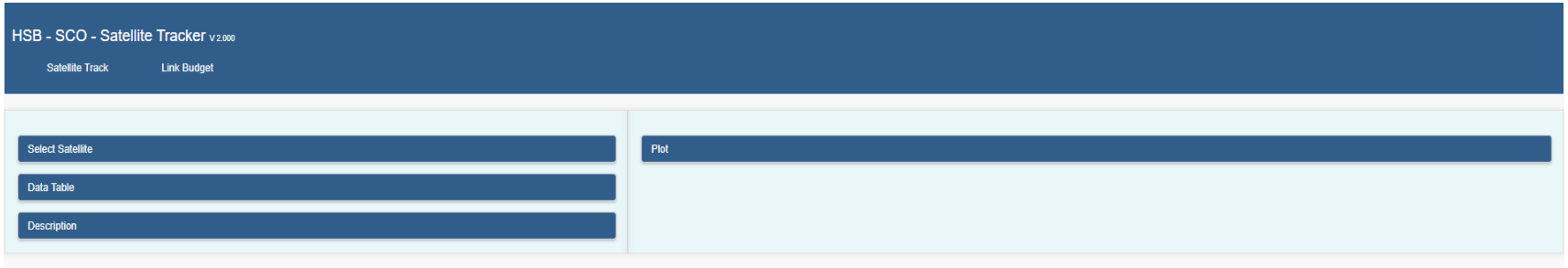
The software Satellite Tracker App created as part of the Bremen University of Applied Sciences module 1.8 Satellite Communication WiSe2024/25, with Prof. Dr Sören Peik.

It is based on the theoretical principles and methods taught in this module. It is used to track satellite orbits and calculate the link budget. Python was used for the backend, while the user interface was designed using HTML. Flask was used as the framework to enable efficient communication between the frontend and backend.

The menu bar offers two buttons, each of which opens a page for satellite tracking and for creating a link budget. The required satellite data is obtained from Celestrak in the form of Two-Line Element (TLE) data to enable precise orbit tracking.

2. Structure

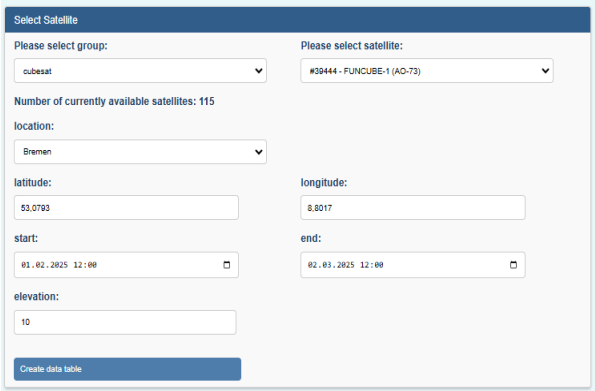
3. Functionality: Satellite Track

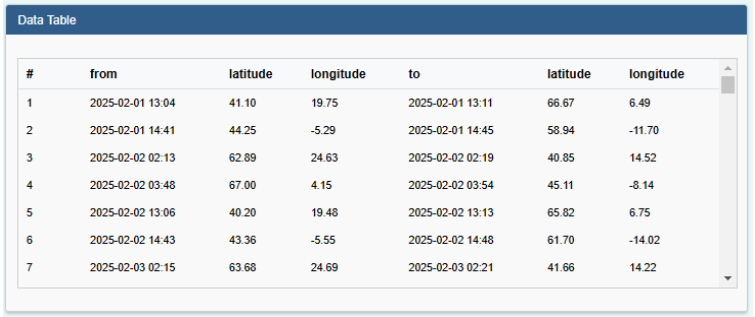


Under Satellite Track, the dropdown menus ‘Select Satellite’, ‘Data Table’, ‘Description’ and ‘Plot’ are displayed.

Clicking on the respective drop-down menu opens a window below with the input and output areas.

3. Functionality: Satellite Track





To select a satellite, first its group (Station or CubeSat) must be selected.

A selection of suitable satellites is then presented.

The location of the ground station can be set individually, whereby Bremen is preset as the default.

The time period to be analysed must be specified as well as the minimum elevation that the satellite should reach in relation to the ground station.

Confirm settings with Create Datatable.

Once the data table has been created, it can be opened. It lists all overflights of the satellite that lie within the defined minimum elevation, numbered. The following data is given for each overflight:

- Time of the AOS (Acquisition of Signal) with corresponding latitude and longitude
- Time of LOS (Loss of Signal) with corresponding latitude and longitude

3. Functionality: Satellite Track

In addition, the Description tab provides a general description of the selected satellite. This information is provided by the NASA Space Science Data Coordinated Archive (NSSDC), a NASA database that collects scientific and technical information on space missions and satellites. However, complete data is not available for every satellite.

The data includes:

- Orbital parameters (e.g. orbital altitude, inclination)
- Launch information and Funding agency
- General description of the satellite and its mission

3. Functionality: Satellite Track

Various visual representations can be created under the Plots tab, including:

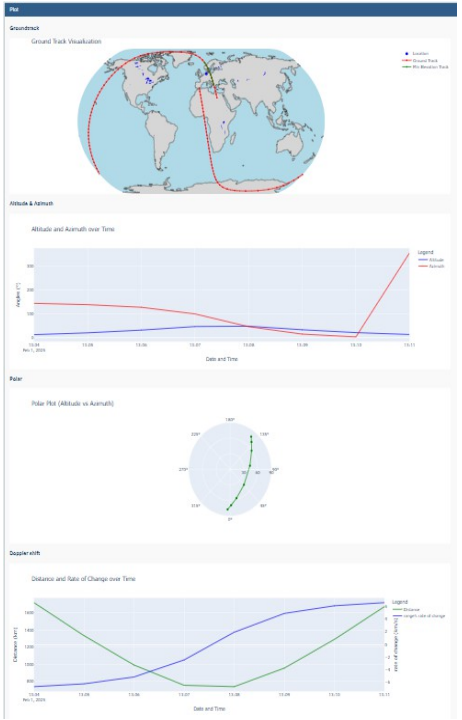
- Groundtrack (ground track of the satellite above the earth(red), ground track within the defined minimum elevation (green)

- Altitude & Azimuth (altitude and direction relative to the ground station)

- Polar Plot (satellite movement in the polar coordinate system)

- Doppler Shift (frequency shift due to the Doppler effect)

To generate the desired plots, a flyover must be selected in the data table. The corresponding diagrams are then created for the selected satellite pass.



4. Functionality: Link Budget

The calculation for creating the link budget is based on the methods from the HS Bremen course ‘Satellite Communication’ (WiSe 2024/2025). The calculation is carried out by manually entering various parameters on the left-hand side of the page, whereby default values are already preset.

After clicking the Create Linkbudget button, the calculated link budget is displayed on the right-hand side. There is also a function for creating and downloading a PDF that saves the results in a clear format.