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CUBESAT GROUND STATION MODULE: TRANSMITTING, RECEIVING AND DISPLAYING CUBESAT DATA THROUGH A WEB-BASED GRAPHICAL USER INTERFACE

Abstract

The work performed in this project is part of the NTNU Test Satellite project, a student satellite project at the Norwegian University of Science and Technology. Setting up a base station for CubeSats is a complex task requiring considerable resources and knowledge in several fields. Extensive work and time is required if all modules and parts of the base station are developed from scratch. This project is an effort to simplify the development process by creating a module/building block for receiving, sending and displaying CubeSat data.

Satellite communication and contact is achieved through a software defined radio (SDR), where the data packets are wrapped in the CubeSat Space Protocol (CSP), as well as the custom NUTS Reliable Protocol (NRP). The protocol unwrapping software will run as a background process on a web server, continuously listening for data transmissions from the satellite, and the communication between the SDR and server will use UDP. Whenever a packet is received its content should be stored on the server, either in a database or as a text file, ensuring a persistent data structure.

The data stored on the server shall be accessed through a graphical user interface (GUI) taking the form of a web page. It is written in Python using the Django web framework, making it easy to extend and maintain. Data is displayed using text boxes as well as graphs showing recent statistics or development of important status parameters.

The GUI will also have the ability to send simple commands to the satellite, requesting data transfers or controlling orbital parameters. The commands will be stored as a time tag list and transferred when the satellite is in range. Predefined commands should be accessed through buttons or drop-down menus, while more customised calls are done via a text interface.

Even though the project is part of NUTS the framework is developed to be accessible and allow for uncomplicated integration into other projects. While the NRP protocol is optional and specific for the NUTS use case, the only required protocols are CSP and UDP. Our goal is that a module of this kind, if user-friendly in its interface and implementation, may boost the motivation for creating a global network of base stations. Such a network which would ensure continuous contact with CubeSats through their orbits.