Projects in the Systems Engineering, Architecture, and Knowledge Lab

Three interdisciplinary projects are available for MAE, Systems, and CS students in the Systems Engineering, Architecture, and Knowledge Lab. All three projects will contribute to the medium-term goal of developing a multi-agent architecture tradespace exploration framework for satellite systems. The three projects involve new software development, based on existing solutions. All software development will be done in Java, Jess, and/or Python in the context of a MadKit-based multi-agent environment.

Research group website: http://www.selva-research.com

Application Instructions

E-mail Prof. Selva (ds925@cornell.edu) with the following materials:

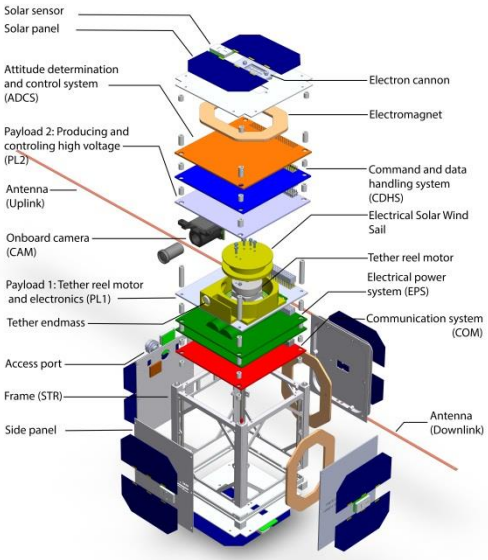
- Updated CV
- Unofficial transcript
- Short paragraph indicating your motivation and preference for a specific project or projects
- Level of effort (number of credits desired)

Projects

Development of a CubeSat Catalog Design Tool

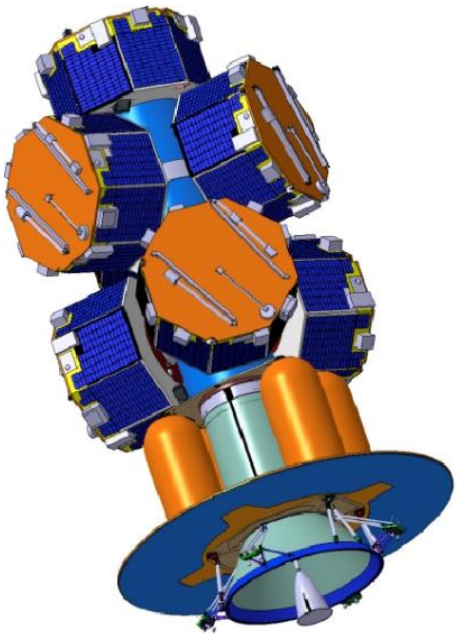
The goal of this project is to develop a CubeSat design tool to be incorporated into our multi-agent framework. The tool will create CubeSat designs by combining components from a relational database containing information about commercially available CubeSat parts.

Two versions of the tool will be created: 1) a forward tool that computes the mass, power, volume, cost and other performance attributes (e.g. pointing accuracy, storage, data rate) given a configuration (i.e. a complete selection of components); 2) a backward tool that given a set of requirements such as payload mass, power, data rate, and so forth provides as an output a set of acceptable designs.



The structure of cubesat ESTCube-1

Development of an Intelligent Spacecraft Configuration Tool



The goal of this project is to develop a Spacecraft Configuration tool to be incorporated into our multi-agent framework. The input of the tool will be a mass and volume budget of the spacecraft subsystems and/or components. The tool will automatically place the different components in their optimal locations using knowledge-based heuristics (e.g., place the batteries near the center of gravity) and a genetic algorithm for optimization.

In addition to the position of each component, the tool will provide as an output a detailed mass and volume budget of the spacecraft in both launch and operational configurations. This information will be used by the launch vehicle selection tool to refine the choice of launch vehicle based on detailed information about the spacecraft configuration.

Development of a SysML-based Interface

The goal of this project is to develop a SysML interface for the multi-agent architecture framework. The interface will have two major components: 1) an architecture representation component that allows the representation of a particular system architecture in SysML based on a complete set of architectural information (e.g., major subsystems, components, and their properties and interconnections); 2) an architecture optimization component that allows the description of a generic system architecture optimization problem in SysML based on a hierarchical tree of architectural decisions where nodes represent decisions with different mathematical structures (e.g., subsets, partitions, permutations, assignments) and edges represent logical constraints between decisions.