RoofSat: Teaching Students Skills for Software Development for GIS Data Collection and Other Activities

Jeremy Straub  
Ronald Marsh  
Donovan Torgerson  
Christoffer Korvald

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Introduction

Small spacecraft provide an excellent platform for the collection of geospatial data. In order to enable the low-cost creation of small remote sensing spacecraft in a university environment, a training pathway for students is required. The Realistic Operational Object for Facilitating Software Assessment and Testing (ROOFSat) serves to provide students with experience developing software for a small satellite platform typical of those used for remote sensing missions. It allows software to be tested with hardware that responds in a similar manner to that found on the satellite for a fraction of the cost of development. This poster details the goals of RoofSat, its implementation to-date and how it is and will be utilized by the small spacecraft software development teams at the University of North Dakota. These includes teams that will be working on the development of control/scheduling software (which will determine how to properly orient the spacecraft for data collection and when to capture imagery), the ground station control software and onboard image/data processing software (which will mosaic and enhance collected imagery).

The value of using small spacecraft, from the perspective of a geographic information system (GIS) user or project scientist, for data collection is discussed. From this, the importance of student training on spacecraft development topics is extrapolated. Also discussed is how enhancements in onboard autonomy of those used for remote sensing missions. It allows software to be tested with hardware that responds in a similar manner to that found on the satellite for a fraction of the cost of development. This poster details the goals of RoofSat, its implementation to-date and how it is and will be utilized by the small spacecraft software development teams at the University of North Dakota. These includes teams that will be working on the development of control/scheduling software (which will determine how to properly orient the spacecraft for data collection and when to capture imagery), the ground station control software and onboard image/data processing software (which will mosaic and enhance collected imagery).

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Department of Computer Science, University of North Dakota

Open Prototype for Educational NanoSats

The Open Prototype for Educational NanoSats (OPEN) aims to make it easier for colleges and universities worldwide to develop spacecraft hardware:

- Flexible platform\(^1\) that can be customized for education and research goals
- Lower cost with parts (excluding payload) costing under $5,000.\(^2\)
- Educational benefit from project-based-learning\(^4,5\)

ROOFSAT Goals

The ROOFSAT allows OpenOrbiter project participants to develop software that can eventually be adapted for use on a spacecraft. The goals of the ROOFSAT include:

- Allowing students to see how their code can manipulate physical objects
- Facilitating testing of spacecraft software prior to the completion of the hardware development
- Allowing students to directly interact with hardware that has similar functionality to flight hardware without the expense or risk to the flight hardware
- Allowing colleges and universities that do not have a small spacecraft program to develop software for use on an OPEN-compliant spacecraft.

OpenOrbiter Project

OpenOrbiter aims to develop a small spacecraft called a CubeSat (which has dimensions of 10 cm x 10 cm x 10 cm and a mass of less than 1.33 kg) which will validate the OPEN designs. The OpenOrbiter spacecraft will be used for remote sensing, with a particular focus on the Upper Midwest United States. Its imagery will be processed onboard, demonstrating the capabilities of super-resolution and mosaicking software.\(^2\) Student learning is also a key goal.\(^4,5\) Demonstration of the benefit of multi-disciplinary project-based learning is also a key goal.

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References

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