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Using Hobby Prototyping Boards and Commercial-off-the-shelf (COTS) Components for Developing Low-cost, Fast-delivery Satellite Subsystems

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Abstract

The use of small satellites has increased significantly in recent years, and a growing community is participating in designing and building space instruments. To achieve lower costs and faster delivery times, and to allow innovative solutions from people with multidisciplinary backgrounds, easy and straightforward development processes and tools are needed. The possibility of having people involved from different areas of expertise than solely space engineering could bring out innovation and approaches that would not otherwise be possible.

This paper presents a process for developing low-cost, fast-delivery satellite subsystems using commercial off- the- shelf (COTS) components and investigates the suitability of a readily available open source hobby development board (Arduino) in the prototyping phase of this process. The process allows participation of external groups to the project with a low threshold. The external group can be a group of experts from different fields, or even a group of students or hobbyists. This practice can facilitate innovation, and lower risks from design uncertainties in the beginning of development. Open source hobby prototyping tools with COTS components have several potential benefits for developing small satellite subsystems: low component and platform prices and shorter development times, achieved by using a platform that takes care of most low-level issues, saves time in the beginning of the prototyping process, and allows earlier subsystem and satellite level verification.

The current study involved the implementation of sun sensor subsystems for Aalto University's nanosatellites using the tools and processes presented herein, and investigated whether the prototyping process and platform is suitable for the task. An included use case goes through the sun sensor subsystem development process, along with specifications needed to build one. The process was successful, and the final subsystem requires an external envelope of only 6 mm * 6 mm * 1 mm for integrating its sensor part, allowing easy integration to solar panels and being one of the smallest and cheapest satellite sun sensors available.

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