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NOVEL BUS ARCHITECTURE FOR SAFE MICRO SATELLITE OPERATIONS

Abstract

Micro satellites have become increasingly common as the first step towards the development of space capability amongst emerging space actors as well as academia. However, having had no prior experience with space operations, these users are often hesitant to experiment with the space platform. Moreover, an absence of adequate back-up sub-systems and fail-safe mechanisms on-board the micro satellite owing to its small size and onboard resources are often the reasons preventing not only novice users but also expert engineers to test new concepts on their existing micro-satellites.

We have developed a novel low-cost bus architecture for micro-satellites that greatly mitigates this threat of damage to the satellite bus from demonstrations carried out by the users. The crux of our solution is a Linux based high-performance onboard computer (HP-OBC) that provides a user space and handles to system optimised application modules using which the users can operate the satellite, build a wide range of custom applications and run any experiments. The user communicates to the entire satellite only through the HP-OBC which in turn communicates to all the sub-systems via a microcontroller based onboard computer (OBC).

Since the users in normal cases only interact with the HP-OBC, the rest of the satellite sub-systems are wholly protected from any unintentional damage from the users' experiments. Even in the most unlikely scenario of an erroneous operation causing a complete failure of the HP-OBC, there are safety measures in place that ensure that the OBC will take control over the entire bus and maintain satellite operations. In that case, the user will be able to access the normal satellite functions (minus the experiment) and operate the satellite normally until the HP-OBC is restored to a working configuration.

In this paper, we will present the architecture of the HP-OBC, its communication interface and protocols with the OBC and thereby the rest of the satellite sub-systems, and the overall impact on satellite operations.