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A NOVEL CPLD-BASED SYSTEM FOR AN AUTONOMOUS MARS ROVER

Abstract

Most applications requiring physical actuation are handled by a controller running on an embedded processor typically running a Linux-like operating system. This processor commands a secondary controller that performs the low-level actuation tasks and hardware interfacing. These tasks require a high degree of parallel computing abilities (like interrupts) so that critical timing processes like counting encoder pulses are executed accurately. When the number of interrupts required by the system increases (for instance due to increased number of encoders), this limited level of parallelism starts failing and we need to think of some serious hardware-level parallelism. For instance, in the Mars Rover prototype developed by us, we employ a mobility system that requires ten encoders to define the state of the suspension and the steering. A standard micro-controller like an Arduino Due starts skipping encoder counts under such conditions. The hardware-level parallelism required can be most easily achieved using a programmable logic device like an CPLD. We design a system on an CPLD that can perform all the real-time tasks required of the actuating controller.