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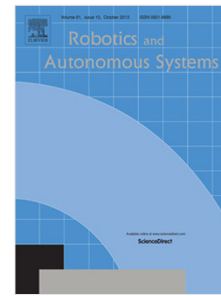
Towards high performance robotic computing

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Towards High Performance Robotic Computing

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Abstract Embedding a robot with a companion computer is becoming a common practice nowadays. Such computer is installed with an operating system, often a Linux distribution. Moreover, Graphic Processing Units (GPUs) can be embedded on a robot, giving it the capacity of performing complex on-board computing tasks while executing a mission. It seems that a next logical transition, consist of deploying a cluster of computers among embedded computing cards. With this approach, a multi-robot system can be set as a High Performance Computing (HPC) cluster. The advantages of such infrastructure are many, from providing higher computing power up to setting scalable multi-robot systems. While HPC has been always seen as a speeding-up tool, we believe that HPC in the world of robotics can do much more than simply accelerating the execution of complex computing tasks. In this paper, we introduce the novel concept of *High Performance Robotic Computing - HPRC*, an augmentation of the ideas behind traditional HPC to fit and enhance the world of robotics. As a proof of concept, we introduce novel HPC software developed to control the motion of a set of robots using the standard parallel MPI (Message Passing Interface) library. The parallel motion software includes two operation modes: Parallel motion to specific target and swarm-like behavior. Furthermore, the HPC software is virtually scalable to control any quantity of moving robots, including Unmanned Aerial Vehicles, Unmanned Ground Vehicles, etc.

Keywords High Performance Robotic Computing - HPRC · General-purpose computing robot · HPC Cluster of robots · HPRC cluster · Parallel Robotic Computing Node - PRCN · General-purpose computing mission

1. Introduction

A robot should be more than a specific-purpose machine, used only for a particular task, designed, and developed with specific hardware and software, making it difficult to integrate with other robots or reuse for a different purpose.

If a robot were to become a *general-purpose computing unit* such as a common computer or a cellphone, it could be reused for different missions and integration with other robots would become transparent. Nowadays, coupling a robot with a companion computer is becoming mainstream, mostly with unmanned vehicles. The advantages of such approach are many because such companion computer is installed with a conventional operating

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