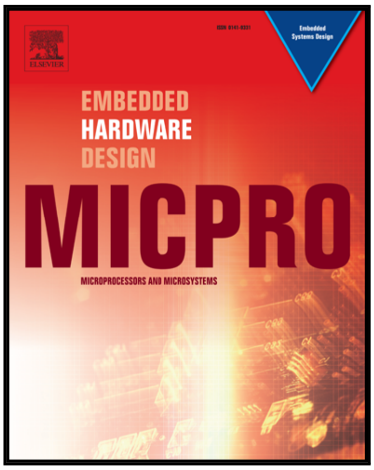

Advanced Mobile and Wearable Systems

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Advanced Mobile and Wearable Systems

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Invited Keynote Paper

Abstract

The recent spectacular progress in the microelectronic, information, communication, material and sensor technologies created a big stimulus towards development of smart communicating cyber-physical systems (CPS) and Internet of Things (IoT). CPS and IoT are undergoing an explosive growth to a large degree related to advanced mobile systems like smart automotive and avionic systems, mobile robots and wearable devices. The huge and rapidly developing markets of sophisticated mobile cyber-physical systems represent great opportunities, but these opportunities come with a price of unusual system complexity, as well as, stringent and difficult to satisfy requirements of many modern applications. Specifically, smart cars and various wearable systems to a growing degree involve big instant data from multiple complex sensors or other systems, and are required to provide continuous autonomous service in a long time. In consequence, they demand a guaranteed (ultra-)high performance and/or (ultra-)low energy consumption, while requiring a high reliability, safety and security. To adequately address these demands, sophisticated embedded computing and embedded design technologies are needed. After an introduction to modern mobile systems, this paper discusses the huge heterogeneous area of these systems, and considers serious issues and challenges in their design. Subsequently, it discusses the heterogeneous embedded computing and design technologies needed to adequately address the issues and overcome the challenges in order to satisfy the stringent requirements of the modern mobile systems.

Keywords

Cyber-Physical Systems; Mobile Systems; Heterogeneous Systems; Massively Parallel Systems; Multi-Processor Systems on a Chip; Automated Design Technology

1. Introduction

The recent nano-dimension CMOS technology nodes enabled implementation of a very complex multi-processor system on a single chip (MPSoC) that may involve hundreds of different parallel processors, substantial memory and communication resources, and realize high-performance computations in an energy efficient way. This facilitated a further rapid progress in mobile and autonomous computing, global networking and wire-less communication which, combined with progress in sensor and actuator technologies, created new important opportunities. Many traditional applications can now be served much better, but what is more important, numerous new sorts of smart communicating mobile and autonomous cyber-physical systems became technologically feasible and economically justified. Various systems performing monitoring, control, diagnostics, communication, visualization or combination of these tasks, and representing (parts of) different mobile, remote or poorly accessible objects, installations, machines, vehicles or devices, or even being wearable or implantable in human or animal bodies can serve as examples (see e.g. Fig.1). A new wave of information technology revolution is arriving that started to create much more coherent and fit to use modern smart communicating cyber-physical systems (CPS). CPS connected to Internet started to form the Internet of Things (IoT). The modern smart and collaborating CPS are much more effective and efficient than the systems of the past, and they enable advanced optimization of processes based on them. Their wise usage has a big potential to crate

Fig. 1 Modern pace-maker
(Source: https://www.amc.nl/)