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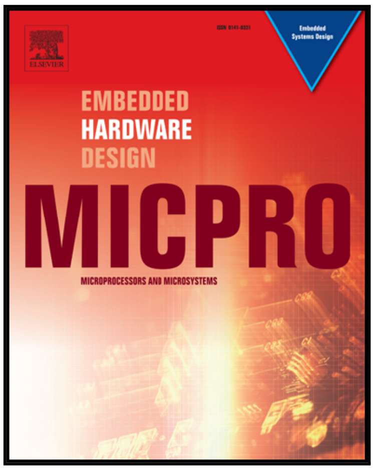

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Novel Online Data Allocation for Hybrid Memories on Tele-health Systems

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Abstract

The developments of wearable devices such as *Body Sensor Networks* (BSNs) have greatly improved the capability of tele-health industry. Large amount of data will be collected from every local BSN in real-time. These data is processed by embedded systems including smart phones and tablets. After that, the data will be transferred to distributed storage systems for further processing. Traditional on-chip SRAMs cause critical power leakage issues and occupy relatively large chip areas. Therefore, hybrid memories, which combine volatile memories with non-volatile memories, are widely adopted in reducing the latency and energy cost on multi-core systems. However, most of the current works are about static data allocation for hybrid memories. Those mechanisms cannot achieve better data placement in real-time. Hence, we propose online data allocation for hybrid memories on embedded tele-health systems. In We present dynamic programming and heuristic approaches. Considering the difference between profiled data access and actual data access, the proposed algorithms use a feedback mechanism to improve the accuracy of data allocation during runtime. Experimental results demonstrate that, compared to greedy approaches, the proposed algorithms achieve 20%-40% performance improvement based on different benchmarks.

Keywords:
Hybrid memory, non-volatile memory, tele-health, data allocation, dynamic programming, heuristic approach

1. Introduction

Tele-health is a novel solution for efficient and long-distance health care services. According to a report by InMedica [1], the global market of tele-health will hit 6-billion by the year 2020. Patients can start video chats with doctors across the country and receive diagnoses remotely. Improvements in *wireless sensor networks* (WSNs) add more features to tele-health services. Patients wear intellectual physiological sensors, which detect health conditions such as *electrocardiography* (ECG), blood pressure, and glucose. A *body sensor network* (BSN) is a cluster of these sensors. It collects signals of sensors and forwards them to doctors with telecommunications. In tele-health, patients can make more flexible medical schedules while doctors can obtain more accurate health care information from patients.

Embedded devices are widely used in tele-health systems due to their unmatched convenience and increasingly computing power. Signals collected from a local BSN can be transmitted to a mobile device of the same patient. The mobile device processes the signals and forwards it to remote medical organizations. Patients can also schedule medical meetings and set up remote diagnoses by using their mobile devices. All these activities are supported by wireless technologies such as WiFi and GPRS.

On embedded systems, compared to single-core solutions, multi-core systems with parallelism can be more energy-efficient for complex tele-health applications. For example, two cores which have the same total size and energy consumption as a large single core can improve the performance of the single core by 40% [2]. However, energy cost is still a critical issue for mobile devices with limited battery life, so an energy-aware design of memory hierarchies becomes important to mobile tele-health systems.

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