North Jersey Communications Chapter

Online Task Scheduling for Fault Tolerant Low-Energy Real Time System

by Piyush Mishra, Michigan Tech

Date: July 5, 2006 (Wednesday)
Time: 4:00 pm
Place: 202 ECEC, NJIT

About the Speaker

Dr. Piyush Mishra is an assistant professor with the Department of ECE at Michigan Technological University. He has published over 15 papers and a book chapter. He is currently an editor for the IEEE Wireless Communications Magazine, and has also guest edited for the IEEE Communications Magazine and the IEEE Journal on Selected Areas on Communications. He is also a frequent presenter at several IEEE Design Automation and Communications Society flagship conferences such as IEEE DAC, ICCAD, ICC and Globecom. He is a recipient of the IEEE DAC graduate scholarship and CISCO Information Assurance Group Scholarship. He is a Member of IEEE, IEEE Communications Society, IEEE Security and Privacy Society, ACM SIGDA and has over 50 national and international research citations to his name. His current research interests include resource-optimum fault-tolerance, efficient and reliable sensor networking, and hardware-based security.

About the Talk

In the past need for reliability has been more stringent in mission critical applications, for example, in space and military domains. But, due to the deployment of an ever increasing number of embedded systems in daily life products, expectancy of failures has reduced significantly even in non-critical applications. On other hand, their susceptibility to radiation-induced faults is increasing due to increasing level of integration, reducing size of transistor features, and lowering of voltage levels. Common examples include mobile devices and sensor networks deployed in open fields which operate under harsh environmental conditions and suffer frequent jolts and exposure to radiations. In this talk we investigate fault tolerance in hard real-time embedded systems.

Provisioning for fault tolerance in real-time embedded systems is a challenging problem, particularly in battery-powered systems, where fault detection and correction overheads have an adverse impact on both time and energy constraints. In this talk we present two low-complexity fault-aware scheduling algorithms that combine feasibility analysis of Rate Monotonic Algorithm (RMA) schedules and DVS-based frequency scaling using exact characterization of RMA algorithm. These algorithms lay the foundation for highly efficient online schemes that minimize energy consumption by adapting DVS policies to runtime behavior of tasks and fault occurrences without violating the offline feasibility analysis. Simulation results demonstrate energy savings up to 60% over energy-efficient offline scheduling algorithms. Significance and impact of online scheduling schemes will be presented and future directions for research will be discussed.

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