Transmit or Discard: Optimizing Data Freshness in Networked Embedded Systems with Energy Harvesting Sources

**ABSTRACT**

This paper explores how to optimize the freshness of real-time data in energy harvesting based networked embedded systems. We introduce the concept of Age of Information (AoI) to quantitatively measure the data freshness and present a comprehensive analysis on the average AoI of the real-time data with stochastic update arrival and energy replenishment rates.

Both an optimal offline solution and an effective online solution are designed to judiciously select a subset of the real-time data updates and determine their corresponding transmission times to optimize the average AoI subject to energy constraints. Our extensive experiments have validated the effectiveness of the proposed solutions, and showed that these two methods can significantly improve the average AoI by 47.2% comparing to the state-of-the-art solutions for low energy replenishment rate.

This paper was presented in the Design Automation Conference 2019 (DAC 2019), 2-6 June 2019, Las Vegas, Nevada, USA.

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Research interests: Embedded Systems