ABSTRACT

With the worldwide deployment of the internet of things (IoT) and cyber-physical systems (CPS), it is now inevitable to ensure the real-time exchange of fresh information in time-critical applications. Age of information (AoI) is a currently introduced metric that is getting vivid attention in recent times for measuring the freshness of information. In this work, an industrial cyber-physical system (ICPS) consisting of a centrally controlled symmetric wireless sensor-actuator network (WSAN) is considered. Real-time sensor updates, with or without deadlines, are sent to the controller for monitoring and closed-loop control of the network. These samples get dropped and/or replaced by fresh new samples with new deadlines once they fail to get service within their stipulated deadline. This work aims to accomplish the objective of maximum information freshness for real-time sensor updates in time-sensitive industrial applications under Industry 4.0. But, in CPS, the coexistence of cyber and physical units and their individual requirements make the problem sheer challenging in maintaining the quality of service (QoS) of the system. For this purpose, we have defined one new term called 'utility of information' and proposed four low complexity greedy scheduling algorithms viz. Highest Age First (HAF), Highest Latency First (HLF), Deadline-aware Highest Latency First (HLF-D), and Deadline-aware Highest Latency First Advanced (HLF-D*). Moreover, their application-specific optimality are proved analytically, and the performances have been analyzed, verified, and compared with other popular policies by extensive simulations.

Arpita Sinha