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| **Abstract:** |  |
| Wireless Body Area Networks (WBANs) are recognized as innovative technology for personal health monitoring. In WBANs, physiological sensor data must be transmitted to the local processing unit (LPU) with minimal age of information (AoI) based on sensor data priority. However, the limited resources of sensors, such as energy, computational capacity, caching and bandwidth, make AoI minimization challenging. Additionally, dynamic radio links caused by body movement and interference further complicate the task. This study aims to minimize the weighted cost of time average AoI and energy consumption by adaptively controlling the transmit power based on real-time distance variations between the sensor and LPU, while allocating priority-aware bandwidth under quality of service and resource constraints in continuous decision space. To solve the non-linear problem, a particle filter-assisted Lagrange relaxation with Karush–Kuhn–Tucker conditions (PF-LKKT) framework is proposed. A recursive particle filter based on received signal strength and motion-sensor data is employed for accurate distance estimation. Then, according to the distance variation adaptively transmit power and data priority-aware bandwidth is jointly allocated. Simulation results demonstrate the superiority of the proposed framework over existing techniques. | |