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Energy-aware hybrid MAC protocol for IoT enabled WBAN systems

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Abstract:
Energy efficiency is an important quality-of-service requirement that needs to be considered when designing an efficient MAC protocol for a WBAN system due to the limited power resources of biomedical sensor devices. To address this, an energy-aware multi-group hybrid MAC (MG-HYMAC) protocol is proposed in this work to improve energy efficiency as well as the lifetime of the biomedical sensor devices in a personalized healthcare system. The proposed protocol combines both the advantages of the CSMA/CA and the TDMA schemes to enable the biomedical sensors to efficiently contend for transmission opportunities and to allow them to efficiently transmit health data. The MG-HYMAC protocol is combined with a transmission scheduling technique to duty cycle the operations of the biomedical devices with less critical data to determine when and how the biomedical sensor devices will transmit their health data packets in order to reduce collisions to save energy and prolong the battery lifetime of the biomedical sensor devices so as to improve the overall network lifetime. Also, a stochastic probability model and a heuristic-based power control scheme are developed to solve time allocation and power control problems to improve energy efficiency and the biomedical sensor devices lifetime. To validate the MG-HYMAC protocol, it was compared with other related protocols (including HyMAC and CPMAC) and simulated in MATLAB. The simulation results proved that the proposed MG-HYMAC protocol outperformed the existing MAC protocols using standard metrics like energy efficiency, biomedical sensor devices lifetime, and convergence speed.