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A hybrid multi-Class MAC protocol for IoT-enabled WBAN systems

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Abstract

This study proposes a hybrid MAC protocol that can efficiently and effectively optimize the communication channel access of a WBAN multi-class system. The proposed protocol consists of two major processes that include the contention phase (CP) and the transmission phase (TP). In the CP, only the biomedical devices that have health packets to transmit randomly contend with equal probabilities using a slotted ALOHA scheme for transmission opportunities and the successful biomedical devices are allocated a transmission time-slot by employing a reservation-based time division multiple access (TDMA) scheme in the transmission phase. A multi-objective optimization problem was formulated to maximize the system sum-throughput, packet success-access-ratio, as well as the reservation ratio, and solved by the controller (i.e., access point) to determine the optimal length of the CP and the number of biomedical devices that can transmit in the TP. Monte Carlo simulation was performed and the optimization solution improved the proposed protocol's performances. For validation purposes, the simulated results in MATLAB revealed that the proposed protocol performs better than the contemporary system in the context of the system sum-throughput, reservation ratio, and the average health packet delay with performance gains of about 9.2%, 9.5%, and 9.6% respectively.