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A mechanism for energy efficiency in cognitive radio sensor networks based on sleep-wake scheduling strategy

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Abstract:
Inefficient energy utilization in the cognitive radio sensor networks (CRSNs) is a serious challenge that adversely affects its performance and quality of service (QoS). Several different strategies and mechanisms have been proposed and developed to address the rapid energy depletion faced by cognitive sensor nodes. However, optimum energy efficiency is yet to be fully realized in the CRSN. Therefore, this paper proposes an energy-efficient scheduling mechanism for CRSNs that is based on both the K-Means clustering and Sensor-Medium Access Control (S-MAC) protocol to minimize high energy utilization. The K-Means algorithm clusters the cognitive sensor nodes to minimize the overall network complexities while the S-MAC protocol performs periodic data transfer and sleep-wake cycles to regulate data flow and minimize interferences. Simulations were performed to analyze the design using six different S-MAC's duty cycles based on throughput, the average energy used, the residual energy, and delay as metrics. This was used to identify the optimal duty cycle for energy-efficient CRSN implementation. Results obtained revealed a 10% duty cycle as the most suitable energy-efficient approach in terms of the metrics considered. We, therefore, recommend a 10% duty cycle for the implementation in designing an energy-efficient model in CRSNs.