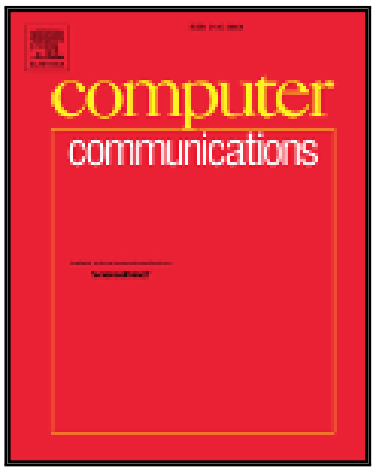

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Fuzzy-Interval based Probabilistic Query Generation Models and Fusion Strategy for Energy Efficient Wireless Sensor Networks

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Abstract: Maintaining the desired service norm in wireless sensor networks (WSNs) over a stipulated lifetime is an important issue as it influences the application or utility of such networks. Inevitably, the impact of uncertainties in query generation process is of significant importance and it rely upon the associated spatio-temporal parameters. Usage of a probabilistic model is investigated to treat the inherent uncertainties. Queries inter-arrival-time-rate (Δt) and spatial distribution or density (Δa) are incorporated to regulate the parametric Poisson PMF model. Instead of considering crisp values of Δa and Δt that devoid parametric uncertainty, the values are inferred using plane-intervals and fuzzy-intervals. A mathematical framework is presented considering Poisson PMF model with parametric intervals, sink attributes in particular its multiplicity and motion aspects, and the quadrants fusion concept by deliberately modeling the problem in high-dimension space. To validate the proposed approach, uses of four different clustering schemes namely SKM, SFCM, DKM and DFCM are investigated. Combinations of sink attributes and quadrants fusion are carried out as different network scenarios. Obtained simulation results demonstrate the benefit of involving specific sink attributes and enabling quadrants fusion strategy. Based on energy metrics assessment, inference about early estimate of initial energy reserve (IER) or its sufficiency is established.

Keywords: ARES, CRES, Fuzzy-Intervals, DFCM, Spatio-temporal aspects, Poisson PMF, STD, Quadrants Fusion, Network lifetime, WSN.