Assignment #5

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The conference paper titled "An Intelligent Routing Approach for Wireless Sensor Networks" presented by Dr Najla Al-Nabhan, and Dr Sami Al-Wakeel is an interesting read for Wireless sensor networks and IoT researchers.

The paper brings to light how wireless sensing technology applications faces many challenges, mainly caused by communication failures, storage and computational constraints and limited power supply. In the five-section paper, they have presented the problem and a fitting solution to counter the problem effectively.

Section 1 - INTRODUCTION:

In this section, we are introduced to the research topic- Wireless Sensor Networks (WSNs). The writers rightly suggest that WSNs present a revolution in the field of wireless communication and embedded systems as they allow new generations of applications in areas such as environmental monitoring, military and security, health care, structural-health monitoring, intelligent transportation systems, Internet of Things (IoT), and as a part of many smart systems such as smart cities.

We know that in WSN, data transmission is performed in multi-hop fashion, however this form of communication possibly floods the network with many data packets due the multiple broadcasts.

Further, reinstating that finding an intelligent routing approach with energy-efficiency and self-organizing property is an important research problem in wireless sensor networks.

Section 2 - INTELLIGENT ROUTING APPROACH WITH ENERGY EFFICIENCY FOR WIRELESS SENSOR NETWORK

Then we move to section 2 of the paper that presents the detailed design of how researchers approach the problem. We then see what are the contents of each data packet in network, M-bits source node address, M-bits address for every transient node (optional), K-bits data, and X-bits packet ID. In total, the data packets contain [M+K+X] bits.

The paper details how this approach achieves energy efficiency by minimizing packet retransmission caused by transient nodes. It does so, apparently, by allowing the transient sensor nodes to response intelligently for receiving data packets from source nodes.

In their approach, they intent to maximizes the lifetime of sensor nodes by considering the residual energy level as a major criteria for the participation in the cooperative packet routing.

Based on its energy level, a transient node may not participate in data transmission if its current energy level is less than a predefined energy threshold (Emin).

Section 3 - PERFORMANCE EVALUATION AND RESULTS

In this section, the paper discusses the design of the simulation experiment. It consists of the following:

A. Simulation Setup: To model and study the underlying network.

Their typical network characteristics includes

1) A fixed Base Station (BS),
2) sensor nodes- homogeneous and energy constrained
3) sensors have no location information,
4) not all nodes are able to reach BS,
5) symmetric propagation channel: that means the energy required to transmit a packet from node A to node B is the same as the energy required for transmitting a packet from node B to node A.

Transmission range, Dmax, depends of number of nodes within this distance to the base station and is a key parameter that has a significant impact on the network operational lifetime.

B. Performance Measures: The main performance measures are as follows: Throughput (Thr), Delay(D), Delay Time Jitter (DTJ), the Total Energy dissipations(E), and number of dead nodes.

Section 4 – SIMULATION RESULTS

In section 4, the simulation results are evaluated and analysed along with detailed discussion. The researchers ran that experiment with input of 40.000 Simulation packets, 20 buffer size, inter-arrival time = 0.5, initial energy per node =101e+7, Duplicate factor=5, and Dmax= 10m, we extract results scalar values: 0, 0.1, 0.5, 1, 2, 5, and 10.

The scalar value is the waiting time before re-transmission time. Zero in case of flooding.

Simulation shows that the zero value for the scalar results a poor performance since the approach behaves similar to Flooding algorithm.

The simulation results obtained by the researcher suggest that, a higher scalar value does not always mean higher throughput. It is important when determining scalar value is to balance between our tendencies to save the retransmission energy, minimize delay caused by scalar factor, and utilize the available node resources.

The optimal value for the scalar depends on the underlying network state and type of application. For their simulation, researchers found the best scalar value is between 0.1, 0.5 and 1 as it has the best throughput, increased storage sharing and less delay than other values.

Section 5 – CONCLUSION

In this paper, the authors proposed an intelligent routing approach for wireless sensor with a view of prolonging the lifetime of the network. Their solution is expected to deliver WSN-based applicable improvements including optimizing energy consumption and prolonging the operational lifetime of the network.

These optimizations are particularly helpful in applications where accessing network sensors is either difficult or dangerous, such as extreme environments, highways, military field, and underground/underwater applications of WSNs.

In their research, the contributors concluded that an intelligent routing scheme as such discussed above is paramount to successful, long lasting, and energy efficient Wireless Sensor Networks.

The conference paper motivates and paves the way for future research in WSNs to counter the power constraints of the system and explore alternatives to message flooding by using intelligent approaches at the network and perception layers in sensor networks.

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