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Effects of Transmission Range on EENDMRP for Wireless Sensor Networks

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Many existing energy efficient routing protocols in wireless sensor networks attempt to reduce the energy usage in data routing from the source to sink. Multipath routing protocol is an efficient alternative mechanism to increase operational lifetime in wireless sensor networks. The effective transmission range is also equally important to increase the network lifetime. While increasing a node's transmission range allows less number of hops between a source and destination and enhances overall network connectivity, it effects in inefficient bandwidth and node residual energy usage. Energy efficient node disjoint multipath routing protocol is used to study the effect of the transmission range in wireless sensor networks. This paper evaluates the effect of various parameters such as number of paths generated, total and average energy spent in wireless sensor networks.

Keywords: Node Disjoint, Multipath, Proactive Routing, Transmission Range, Wireless Sensor Networks

1. INTRODUCTION

Due to advances in wireless communications and electronics over the last few years, the development of networks of low-cost, low-power, multi functional sensors has received increasing attention. A Wireless Sensor Network (WSN) is a multidisciplinary research area, which contributes to a variety of open issues like application domain, hardware, communication and networks in order to implement an efficient system [1][2][3][4].

WSN is a variant of mobile ad hoc network consisting of finite number of tiny, autonomous devices called wireless sensor nodes. A sensor network is designed to detect events or observe the phenomena, collect and process data, and transmit sensed information to sink node.

Routing the sensed data from the source to sink node in a resource constrained environment in WSN is still a challenge [5]. An optimal path is selected based on the metrics such as the gradient of information, the distance to the destination or the node residual energy level [6][7] to route the data between source to destination.

The optimal path between the source and destination is selected by the routing protocols to satisfy the resource constraints such as energy, bandwidth and power computation [8][9]. The routing protocols take into account the metrics like minimum hop, minimum transmission cost, high residual energy, etc., to route the data [10][11].

Many routing protocols attempt to reduce the energy usage in the nodes to increase the network lifetime [12][13]. This provides an optimal path between source and destination. Selecting an optimal path between the source and destination and sending the data through that path may not increase the lifetime of the network. The energy usage in such an

Table 1
The Effect of Transmission Range in Node Residual and Average Energy Spent

Trans. Range in mtrs	Number of paths	Number of Nodes	Total Spent Energy	Average Energy Spent
20	2	16	30.66	1.9162
25	3	15	28.677	1.9118
30	4	16	30.57	1.9106
35	3	12	22.9859	1.9154
40	8	24	45.5665	1.8960

5. CONCLUSIONS

Increase of network operational lifetime is a critical research issue in wireless sensor networks. Many multipath routing protocols for wireless sensor networks are proposed to increase the network lifetime by selecting the optimum route selection criteria. The work proposes EENDMRP to increase the network operational lifetime by distributing the data traffic among the multiple paths effectively. The load sharing algorithm in EENDMRP reduces the variance among the residual energy level in the nodes on multi path by 93.3% . The residual energy level after the data transfer lies around 3.054 Joules.

This work investigated the effect the different transmission range under the EENDMRP. The study infers that, even though larger the transmission range effects better connectivity it fails to spend the node residual energy effectively. When the transmission range is 20 meters and 40 meters, the number of paths generated are 2 and 8 respectively. The number of paths generated is 3 when the transmission range is 30 and 35 meters. There is an 25.1% ,24.8% and 49.5% of total energy saving when data is transmitted through the 3 number of node disjoint paths compared to 2, 4 and 8 paths respectively.

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