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Efficient energy utilization protocol for WSNs

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Abstract
On-time emerging technology of research is increasing requirement for a real-time application in Wireless Sensor Networks (WSNs) has made the quality based communication protocols an interesting and hot research topic. More precisely, the networking protocols need to cope up with energy constraints, while providing precise quality guarantee. In many of these applications, the network traffic is mixed of delay sensitive and delay tolerant traffic. Hence, Quality of Service (QoS) routing becomes an important issue. The main objective of this idea is to develop the path for quality of network and to further improve throughput, routing overhead and bandwidth and at the same time to create energy enhanced way with excellent QS. In this research paper, the propose model an Energy Efficient Quality Routing Protocol (EEQRP) technique based on energy efficient protocol that can be used to design fast, tiny, more energetic and efficient way then existing routing protocols, they evaluate and compare the performance of our routing protocol (EEQRP). Network Simulator (NS2) is used to carry out and test the proposed system achieves lower average delay, more energy savings, and higher packet delivery ratio than the existing protocol.

Keywords: WSNs, network quality, EEQRP, PDR, delay, energy

1. Introduction
A typical WSN consists of a number of sensor devices that collaborate with each other to accomplish a common task. The areas of applications of WSNs vary from civil, healthcare, and environmental to military. However, with the specific consideration of the unique properties of sensor networks such limited power, stringent bandwidth, dynamic topology, high network density and large scale deployments have posed many challenges in the design and management of sensor networks. These challenges have demanded energy awareness and robust protocol designs at all layers of the networking protocol stack. Efficient utilization of sensor's energy resources and maximizing the network lifetime were and still are the main design considerations for the most proposed protocols and algorithms for sensor networks and have dominated most of the research in WSNs. However, depending on the type of application, the generated sensory data normally have different attributes, where it may contain delay sensitive and delay tolerant data. The QoS based protocols allow sensor nodes to make a trade-off between the energy consumption and some QoS metrics before delivering the data to the sink node. Finally, multi-path routing protocols use multiple paths rather than a single path in order to improve the network performance in terms of reliability and robustness. Multi-path routing establishes multiple paths between the source and destination pair. Multi-path routing protocols have been discussed in the literature for several years now. Multi-path routing has focused on the use of multiple paths primarily for load balancing, fault tolerance, bandwidth aggregation, and reduced delay. We focus on supporting quality of service through multi-path routing. In this paper, we propose EEQRP protocol for WSNs to recover from node failures and achieve load balancing through splitting up the traffic across a set of available node-disjoint paths in order to efficiently balance the energy consumption over multiple sensor nodes. Furthermore, EEQRP increases the reliability of data delivery through utilizing a light weight XOR-based forward error correction technique to provide data redundancy. EEQRP uses the residual energy, node available buffer size, and signal-to-noise ratio to predict the next hop through the path construction phase.

2. Proposed Method
In this section, description of EEQRP protocol define some assumptions, then they provide the details of multiple paths discovery and maintenance, as well as the traffic allocation and data transmission across the multiple paths steps given below.

Step 1: HELLO message structure Assumptions

Source ID	Hop Count	Residual Energy	Free Buffer	Link Quality

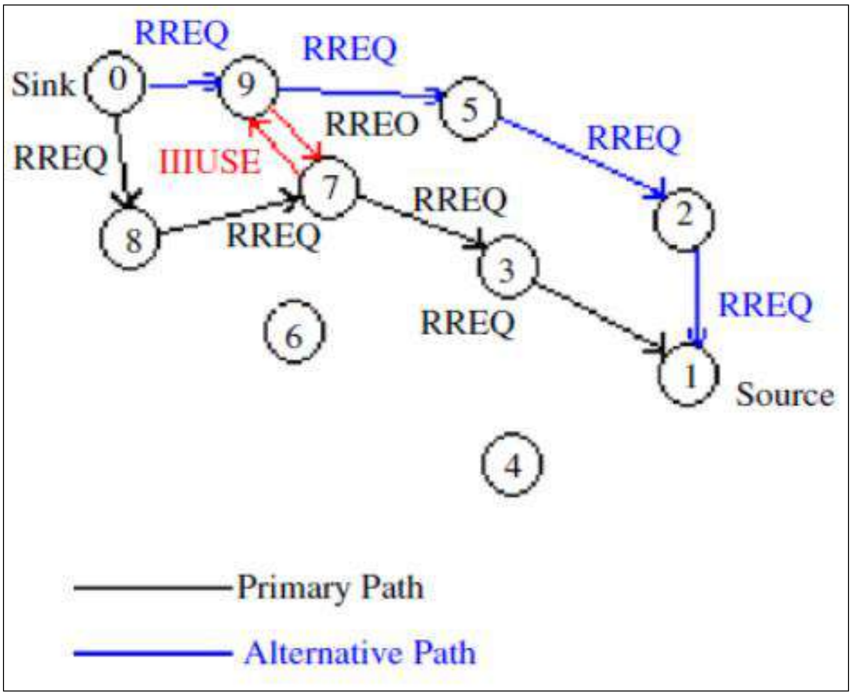
Step 2: Link cost function

$$\text{Next hop} = \max_{y \in Nx}\{\alpha E_{resd,y} + \beta B_{buffer,y} + \gamma I_{interference,xy}\},$$

$$C_{total,P} = \sum_{i=1}^{K-1} l_{(xy)_i}$$

Step 3: Paths discovery phase / RREQ message structure

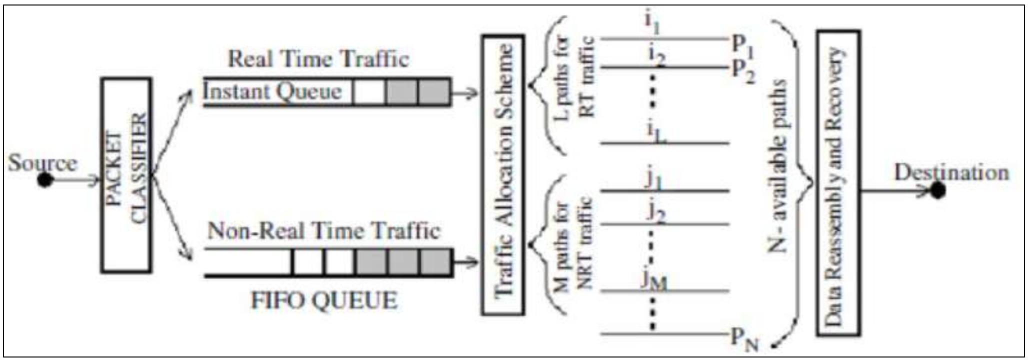
Source ID	Dest. ID	Route ID	Residual Energy	Free Buffer	Link Quality	Route Cost



Step 4: Paths selection

$$k = x_{\alpha}.\sqrt{\sum_{i=1}^{N} p_i(1-p_i) + \sum_{i=1}^{N} p_i}$$

Step5: Functional diagram of the EEQRP



3. Results and Discussion

Our simulation environment consists of 350 sensor nodes selected randomly in an area of 680 m*680 m with transmission range set to 25 m all nodes are identical. Table 1 shows the simulation parameters. The parameter metrics used in the evaluation are the remaining energy, throughput and average delay. Simulation results are averaged over several simulation runs. Figure 1 show the graph of the PDR when the topology size is increased 1m to 680 m, the number of sensors 300.

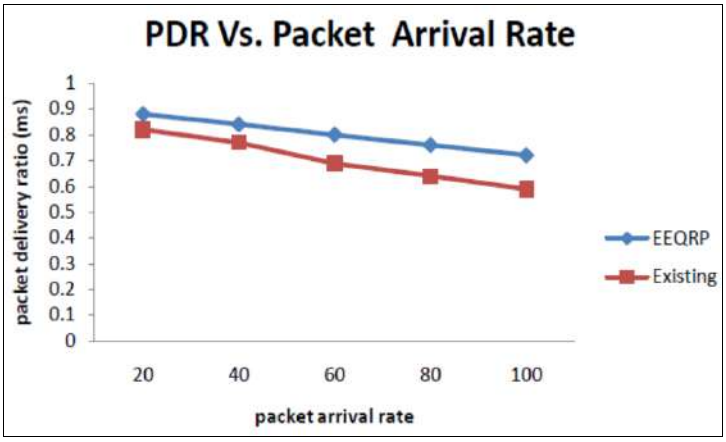


Fig 1: PDR vs Packet arrival rate

It is clear from the simulation results that the EEQRP has the highest delivery ratio in comparison with existing, when there are 1 to 300 sensors. When the number of sensors increases, the connectivity among the nodes also increases; this enables the proposed method to identify efficient paths which in turn increase the delivery ratio

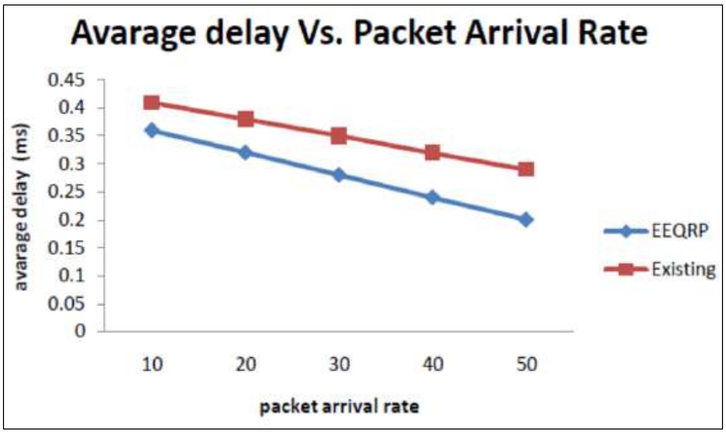


Fig 2: Average delay Vs. Packet arrival rate

It is observed from Figure 2 that when compared with exiting protocol, EEQRP decreases the delay by 7% with the increase in the number of sensors from 1 to 300. The proposed algorithm EEQRP finds the primary and secondary highest forward capacity route in between the sender and receiver**.**

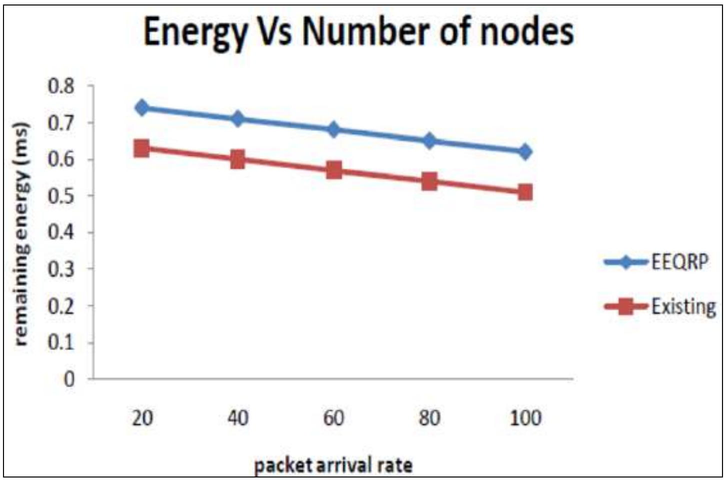


Fig 3: Remaining energy Vs. Packet arrival rate

From figure 3 and describe the increase in the remaining energy obtained by the proposed EEQRP when there are 1 to 300 sensors. EEQRP protocol reduces the energy by 11% as the proposed algorithm.

4. Conclusion

Our EEQRP protocol; an energy efficient and quality aware routing protocol designed for WSNs to provide service differentiation by giving real-time traffic absolute preferential treatment over the non-real-time traffic. Simulation results have shown that our protocol (EEQRP) provides better performance compared to the existing protocol and also improves more remaining energy to more than 11% compared to the existing protocol, improves delivery ratio 8% to more compared to the existing routing protocol, and minimize average delay below 7% compared to the existing Protocol. Finally EEQRP not only reduces delay but also reduces routing overhead. Our future work, apply proposed protocol (EEQRP) to analysis various environments reduce maximum energy, apply different secure algorithm to provide effective secure communication, testing the performance of EEQRP in real network environment instead of software simulation.

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