



# **Cluster Head with Multiple Base Stations Can Lead To Extended Lifetime of WSN**

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**Abstract:** Wireless Sensor Networks (WSN) are networks of typically small, battery-powered, wireless devices, equipped with on-board processing, communication, and sensing capabilities. Specifically wireless sensor network suffers from excessive packet loss, mixed hearing, retransmission of the packets due to node mobility and constant energy debauchery. A current technique for routing and data transmission does not take into account of optimizing the transmission through Energy Balancing. There are several power and energy aware algorithms that claim to compensate for the energy losses. The main fundamental of most of the techniques is to route the packets through the highest energy nodes which lead to quick battery drainage of those node. Therefore the network lifetime decreases. In this paper we have proposed a unique protocol for Network lifetime extended by modifying the Leach protocol. The fundamental of the protocol is to develop a cluster based routing where cluster heads should be selected based on maximum coverage and should have sufficient energy to prolong the communication. Clusters are automatically formed and changed with transmission. Evaluation and Result show that the proposed system achieves high data delivery with extended lifetime.

## **I. INTRODUCTION**

[2] Recent advances in wireless communication technologies and the manufacture of inexpensive wireless devices have led to the introduction of low-power wireless sensor networks. Due to their effortlessness of deployment and the multi-functionality of the sensor nodes, wireless sensor networks have been utilized for a variety of applications such as healthcare, target tracking, and environment monitoring. The main responsibility of the sensor nodes in each application is to sense the target area and transmit their collected information to the sink node for further operations. Resource limitations of the sensor nodes and unreliability of low-power wireless links, in combination with various performance demands of different applications impose many challenges in designing efficient communication protocols for wireless sensor networks. Meanwhile, designing suitable routing protocols to fulfil different performance demands of various applications is considered as an important issue in wireless sensor networking. In this context, researchers have proposed numerous routing protocols to improve performance demands of different applications through the network layer of wireless sensor networks protocol stack.[8][3] Most of the existing routing protocols in wireless sensor networks are designed based on the single-path routing strategy without considering the effects of various traffic load intensities. In this approach, each source node selects a single path which can satisfy performance requirements of the intended application for transmitting its traffic towards the sink node. Although route discovery through single-path routing approach can be performed with minimum computational complexity and resource utilization, the limited capacity of a single path highly reduces the achievable network throughput. Furthermore, the low flexibility of this approach against node or link failures may significantly reduce the network performance in critical situations. For instance, whenever the active path fails to transmit data packets such as a result of limited power supply of the sensor nodes, high dynamics of wireless links and physical damages, finding an alternative path to continue data transmission process may cause extra overhead and delay in data delivery. Therefore, due to the resource constraints of sensor nodes and the unreliability of wireless links, single-path routing approaches cannot be considered effective techniques to meet the performance demands of various applications. [5] In order to cope with the limitations of single-path routing techniques, another type of routing strategy, which is called the multipath routing approach has become as a promising



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technique in wireless sensor and *ad hoc* networks. Dense deployment of the sensor nodes enables a multipath routing approach to construct several paths from individual sensor nodes towards the destination. Discovered paths can be utilized concurrently to provide adequate network resources in intensive traffic conditions. Alternatively, each source node can use only one path for data transmission and switch to another path upon node or link failures. The latter one is mainly used for fault-tolerance purposes, and this is known as *alternative path routing*. In the past decade, multipath routing approach has been widely utilized for different network management purposes such as improving data transmission reliability, providing fault-tolerant routing, congestion control and Quality of Service (QoS) support in traditional wired and wireless networks. However, the unique features of wireless sensor networks (e.g., constrained power supply, limited computational capability, and low-memory capacity) and the characteristics of short-range radio communications (e.g., fading and interference) introduce new challenges that should be addressed in the design of multipath routing protocols. Accordingly, existing multipath routing protocols proposed for traditional wireless networks (such as *ad hoc* networks) cannot be used directly in low-power sensor networks. During the past years, many issue has motivated the research community of wireless sensor networks to develop multipath routing protocols which are suitable for sensor networks.

## II. BACK GROUND PAPER

There are several papers surveyed to develop a proposed routing protocol for wireless sensor networks. These surveys describe and analyze the general routing strategies proposed for sensor networks. However, none of these literatures has provided a comprehensive taxonomy on the existing multipath routing protocols for wireless sensor networks. Following authors made us and gave idea and easy way to develop a proposed work.

- **L. Akyildiz, W. Su, Y. Sankarasubramanian and E. Cayirci, "A survey on sensor networks", IEEE Communications Magazine, vol. 40. no. 8, pp. 102-114, 2002.**

Authors presented routing challenges and design issues in wireless sensor networks. They classified all the existing routing strategies based on the network structure and protocol operation. Provided a brief overview on the existing fault-tolerant routing protocols in wireless sensor networks and categorized these protocols into retransmission-based and replication-based protocols.

- **G. N. Bravos and G. Efthymoglou, "MIMO-based and SISO multihop sensor network: Energy efficiency evaluation", Proceedings of IEEE International Conference on Wireless and Mobile Computing, Networking and Communications, 2007**

**G. N. Bravos and G. Efthymoglou**, and *et al.* classified the existing multipath routing protocols in *Wireless sensor networks* s based on the primary criterion used in their design. Accordingly, the principal motivation of conducting this research was lack of a comprehensive survey on the proposed multipath routing protocols for wireless sensor networks. To the best of our knowledge, this paper is the first effort to classify and investigate the operation as well as benefits and drawbacks of the existing multipath routing protocols in sensor networks.

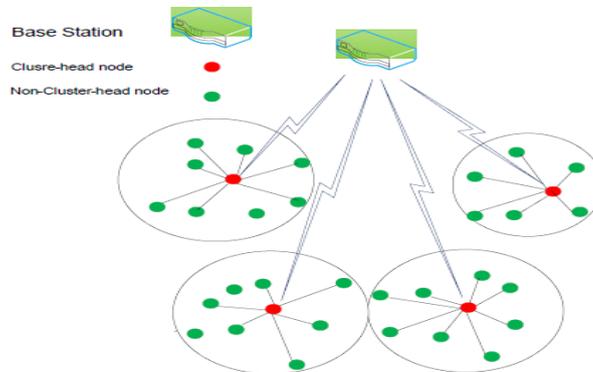
## III. PROPOSED WORK

The fundamental of the protocol is to develop a cluster based routing where cluster heads should be selected based on maximum coverage and should have sufficient energy to prolong the communication. The following Figure 1(a) and 1(b) show the proposed work design and architecture of algorithm EULP(Extended and Updated Leach Protocol) , where we are routing through high energy node. And for cluster formation, selecting node with high node energy.

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1(a) Proposed EULP Design

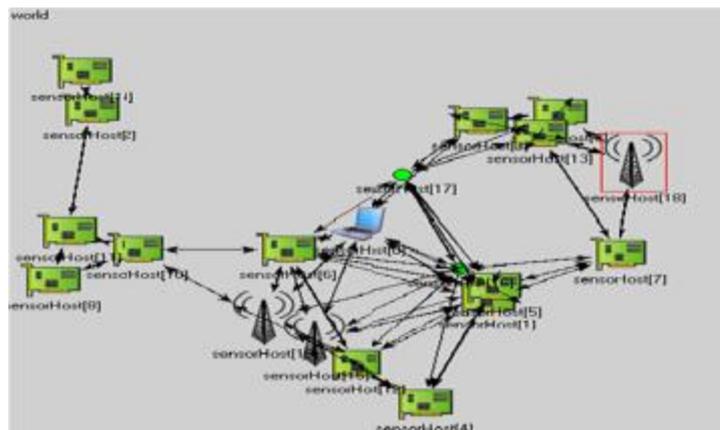


Fig 1(b) Proposed EULP Architecture.

## ALGORITHM EULP

### Algorithm: EULP

- [1]. Let  $W, H$  be the Network width and Height. Network Area  $A=W \times H$ .
- [2]. Let there be  $N$  nodes with  $E_i$  Energy at  $(X_i, Y_i)$  point.
- [3]. Let Node 0 be the Sink node located at  $W/2, H/2$ .
- [4]. The problem can be summarized as to get a connected graph  $G=\{V, E\}$  from  $S$  number of sources such that  $V$  are the Nodes and  $E$  are set of all edges or Links, So as to maximize  $L$  where  $L$  is the Lifetime and is defined as time  $t_l$  when  $E_i \leq 0$ , where  $i$  can be any node other than the Sink.
- [5]. Initially all node broadcast HELLO packets and let the other nodes know their Energy and Position.
- [6]. Initially When Sink wants to gather data from Sources, It Selects the nodes with Maximum Neighbors and Sufficient Energy as Cluster Heads.
- [7]. Each Cluster head is notified that it is cluster head.
- [8]. Source generates RREQ packet.
- [9]. A node forwards RREQ packet only if it is a cluster head.
- [10]. Route is formed between each source to sink through cluster heads.
- [11]. Data is transmitted from source to Sink.
- [12]. Nodes loses Energy as

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- [13].  $E_{loss} = E_{idle} + E_{transmit} + E_{receive}$
- [14]. and  $E = E - E_{loss}$  where  $E_{idle} = 1pJ/s$
- [15].  $E_{transmit} = 3mJ/Package$  (considering packet is of
- [16]. Length 1024)
- [17].  $E_{receive} = 1mJ/Package$
- [18]. During the Transmission if any  $E_i$  is less than 0, mark the time as Network Lifetime.
- [19]. If a cluster head loses its energy below 30% of the Max energy, then it notifies the source. An alternative cluster head is selected, all the routes through previous cluster head generates RERR and new routes are formed.

## IV. EVALUATION AND RESULTS

Following are the parameters used to evaluate the EULP

- Packet Delivery Ratio  
Number of Packet delivered from source to sink/Number of Packets Generated at source Node.
- Latency  
Average time of transmission of all packets from Source to Sink.
- Control Overhead  
Number of Control packet sent( RREQ,RERR, HELLO,RREP)/Number of data packet Delivered.
- Average Energy Consumption

Avg  $(E_{max} - E_i)$  where  $i=1,2,..N$  and  $i!=Sink$ . The analysis of the proposed cluster based routing scheme where cluster heads should be selected based on maximum coverage and should have sufficient energy to prolong the communication. It is carried out using QualNet 7.0 to evaluate the energy consumption and maximize the lifetime of the sensor network. A sensing field of dimension  $W \times H$  ( $W=500$  &  $H=500$  m) with a population of  $N=25$  and 50 nodes is considered for simulation. The system parameters used for nodes 25, 50 for the simulation is listed below. Average cluster lifetime and Latency Average cluster lifetime and Latency For 25 & 50 nodes. In the following fig 2 shows that Average Cluster Lifetime of Proposed EULP is better than Conventional LEACH.

Area	500*500 m
Packet Size	512 Bytes
Initial Energy of node	1000 mJ
Packet Rate	500
Number of Active Session	30
Energy from MAC Module	0.003mJ/bit
	0.001mJ/bit



Fig 2 Average Cluster Lifetime



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## V. CONCLUSION

The conventional sensor network protocols like direct diffusion and Leach fails to ensure the credibility of the network and fails to ensure longer lifetime. The lifetime maximization problem is generally seen as an isolated problem in comparison to QOS problem. In EULP proposed research is QOS aware protocol which is provided that ensures maximum lifetime of the edges through which routing is performed and thus minimizing the losses due to node mobility or collision, thereby enhancing the lifetime by minimizing the Energy losses. Result show that the lifetime of the proposed system is better than the conventional Leach. There are several other factors like bandwidth, delay that affects the performance of the network which is correlated. But resolving the sharp relationships among the parameters are difficult. Hence the work can be further improved by incorporating fuzzy decisions along with hard decision Maximization problem.

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