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Design of EULP with Cluster Head to Cover Maximum Lifetime of WSN

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Abstract: Wireless Sensor Network (WSN) is consisting of independent sensors, communicating with each other to monitor the environment. Sensor nodes are usually attached to microcontroller and are powered by battery. The resource constrained nature of WSN implies various challenges in its design and operations, which degrades its performance. However, the major fact that sensor nodes run out of energy quickly, has been an issue. Many routing, power management, and data dissemination protocols have been designed for WSNs, where energy consumption is an essential design issue, which preserves longevity of the network .In this paper we have presented Extension and updation of cluster based concept to LEACH protocol.(EULP) . Evaluation results shows that proposed EULP provides better life time of WSN

Keyword - EULP, LEACH, WSN, Setup phase, steady phase

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 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 WORK

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

3.1 Conventional Leach

LEACH is one of the most popular clustering algorithms used in WSNs to increase the network lifetime [3]. LEACH is an adaptive, self organizing and clustering protocol. It introduces the concept of Rounds. LEACH assumes that the BS is fixed and located far from the sensors, all sensor nodes are homogenous and have limited energy source, sensors can sense the environment at a fixed rate and can communicate among each other, and sensors can directly communicate with BS. The idea of LEACH is to organize the nodes into clusters to distribute the energy among the sensor nodes in the network, and in each cluster there is an elected **node** called a cluster head (CH). Fig. 1 shows LEACH communication Structure.. Each round in LEACH consists of two phases as shown in Fig. 2. Clusters are formed during the steady phase .

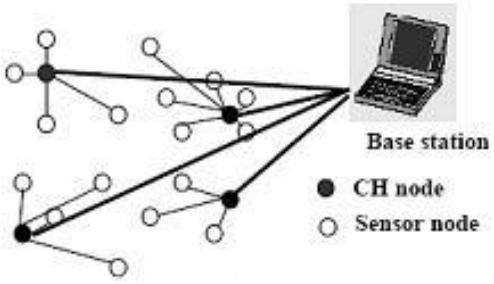


Fig 1 Conventional Leach Structure.

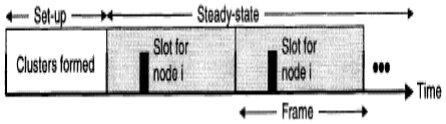


Fig 2 Steady Phase in Conventional Leach

- **The LEACH Network is made up of nodes, some of which are called *cluster-heads***

The job of the cluster-head is to collect data from their surrounding nodes and pass it on to the base station. LEACH is *dynamic* because the job of cluster-head rotates All non-cluster head nodes transmit data to their cluster head. Cluster head receives this data and performs signal processing functions on the data and transmits data to the remote BS(base station).Nodes organize themselves into local clusters, with one node as cluster. This protocol is divided into phases such as

- **Set-up phase(Clusters are organized)**

Cluster Set-Up Phase

After each node has decided to which cluster it belongs, it must inform the cluster head node that it will be a member of its cluster. Each node transmits this information back to the cluster head again using CSMA MAC protocol. During this phase, all cluster head nodes must keep their receivers on.

- **Steady phase(Data transferred from nodes to cluster and on to BS)**

The cluster head receives all the messages from the nodes that would like to join the cluster. Based on the number of nodes in the cluster, the cluster head creates a TDMA schedule telling each node when it can transmit the data. This schedule is broadcasted back to the nodes included in the cluster which show in the following flow chart fig no 3.

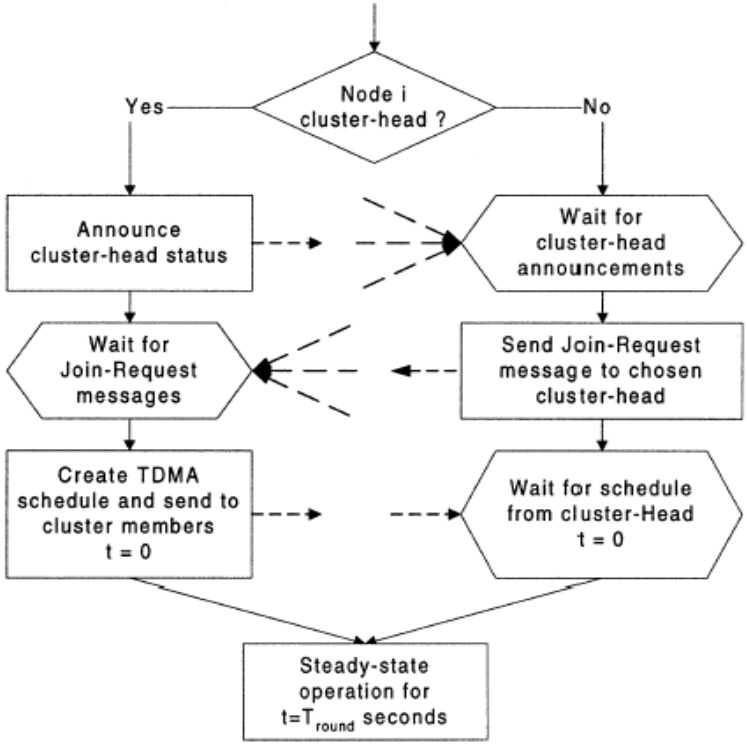


Fig 3 Flow chart for Cluster Formation.

3.2 Proposed EULP with its architecture.

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 4 shows the proposed algorithm, where we are routing through high energy node. And for cluster formation, selecting node with high node energy. Figure 4. 1Proposed Model For Energy Aware Modified LEACH Protocol

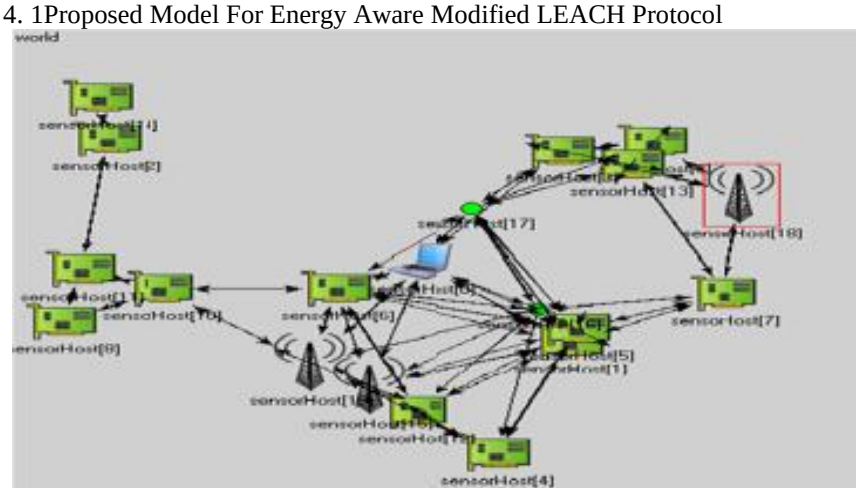


Fig 4.1 EULP Architecture Design

IV. RESULT AND DISCUSSION

Following are the parameter used to evaluate the EULP

- Packet Delivery Ratio

Number of Packet delivered from source to sink/Number of Packets Generated at source Node.

- Latency

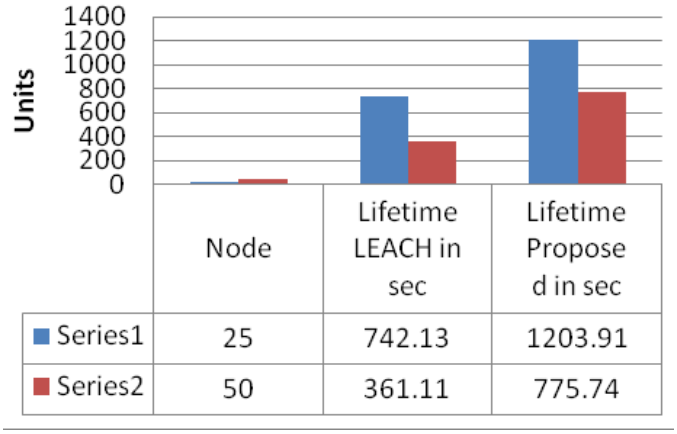
Average time of transmission of all packets from Source to Sink.

- Control Overhead

Number of Control packet sent(RREQ,RERR, HELLO,RREP)/Number of data packet Delivered.

- Average Energy Consumption

  Avg (Emax-Ei) where i=1,2..N and i!=Sink.



	Node	Lifetime LEACH in sec	Lifetime Proposed in sec
Series1	25	742.13	1203.91
Series2	50	361.11	775.74

Figure 5 Comparison of Lifetime for LEACH and Modified LEACH. In this fig. it shows that lifetime of Proposed Modified LEACH is better than LEACH.

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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