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"Some Important Enhancing Protocol Issues For Wireless Sensor Network, A Survey"

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Abstract:

Wireless Sensor Networks (WSNs) consist of small sensor nodes with sensing, computation, and wireless communications capabilities. Sensor nodes sense physical phenomena or collect data from an environment. Sensor nodes have inevitable impact over the network's performance; here are still limitations that WSNs suffer. The energy consumption is one of the most common problems in the wireless sensor network. Innovative techniques that improve energy efficiency to prolong the network lifetime are highly required. Clustering is an effective approach in wireless sensor networks, which can increase network lifetime. In our paper we have surveyed various enhancing clustering protocols for wireless sensor networks and compared on various parameters like, message count, node deployment, Network Lifetime, location awareness and cluster head selection process etc.

Key words: *Cluster head; Energy-Efficiency; Network Lifetime; Wireless Sensor Network (WSN);*

1.Introduction

Recent technological advances in microelectronic mechanical systems (MEMS) and wireless communication technologies have enabled the development of tiny, low-cost, low-power, and multifunctional smart sensor nodes in a wireless sensor network (WSN). These sensors measure ambient conditions in the environment surrounding them and then transform these measurements into signals that can be processed to reveal some properties about the objects located and/or events happening in the vicinity of the sensor. These smart sensor nodes are deployed in a physical area and networked through internet and wireless links, which provide unprecedented opportunities for a variety of civilian and military applications, for example, environmental monitoring, battle field surveillance, and industry process control. The development of wireless sensor networks was originally motivated by military applications such as battlefield surveillance. However, wireless sensor networks are now used in many civilian application areas, including environment and habitat monitoring, healthcare applications, home automation, and traffic control [2]. Wireless sensor networks (WSNs) are becoming increasingly useful in a variety of applications ranging from military operations to civil applications such as target field imaging, intrusion detection, weather monitoring and forecasting, security and tactical surveillance, distributed computing, detecting ambient conditions such as temperature, movement, sound, light, or the presence of certain objects, inventory control, and disaster management, etc. However, sensor nodes are constrained in energy supply and bandwidth. Typically such networks suffer with a few unavoidable problems viz. nodes are unattended, resource-constrained, their energy cannot be replenished because of their deployment over inaccessible terrains and network topology is unknown. The resource-constrained limitations of such nodes make it essential to conserve energy to increase network lifetime and such need for energy-conservation has oriented researches towards finding energy-efficient solutions to some of the conventional wireless networking problems, viz. medium access control, routing, self-organization, bandwidth sharing, and security in order to increase network lifetime. Effective Utilization of the tradeoffs among energy, accuracy, and latency effectively and hierarchical architectures have been proven important techniques to prolong network lifetime [11] [8].

2.Classification Of Clustering Algorithms

There have been substantial amount of research on clustering protocols for WSNs. These clustering protocols are classified according to different criteria. The classification of clustering protocols according to their objectives is given below:

2.1.Dominating-Set-Based Clustering

This type of clustering protocols try to find a weakly connected dominating set which is responsible for searching route and maintaining routing table. Thus, table-driven routing and on-demand routing can be applied easily.

2.2.Low-maintenance clustering

These types of clustering protocols aim to provide a stable cluster structure to upper layer protocols. To achieve this goal, they try to limit reclustering situations or reducing the control messages for clustering.

2.3.Mobility-Aware Clustering

Mobility-aware clustering protocols take the mobility of sensor nodes into consideration. They try to group the mobile nodes that move with similar speed. The clusters that consist of mobile nodes moving with similar speed build a more stable cluster structure for wireless sensor networks.

2.4.Energy-Efficient Clustering

Energy-efficient clustering protocols try to use the battery energy of the sensor nodes more wisely, because sensor nodes have limited battery energy, and they are generally not rechargeable. Energy consumption of sensor nodes can be reduced by eliminating redundant energy consumption and balancing the energy usage of sensor nodes over the network. The main goal of this type of clustering protocols is prolonging the network lifetime.

2.5.Load-Balancing Clustering

This type of clustering protocols tries to limit the number of sensor nodes in each cluster. This approach produces clusters with similar sizes. If the clusters are similar in size, loads can be more evenly distributed within each cluster.

2.6.Combined-Metrics-Based Clustering

As the name implies, this type of clustering protocols consider different metrics together. These metrics can be node degree, battery energy, cluster size, mobility speed, etc. These types of metrics are generally used in cluster-head election phase of clustering protocols.

2.7.Clustering In Wireless Sensor Networks

The differences between WSNs and traditional ad hoc networks are outlined below:

• The number of sensor nodes in a WSN can be several orders of magnitude higher than that in an ad hoc network.

• Sensor nodes are densely deployed.

• Sensor nodes are prone to failures.

• The topology of a WSN may change rather frequently because a sensor node may alternate between the active and sleep states.

• Sensor nodes mainly use broadcast communications, whereas most ad hoc networks are based on point - to - point communications.

• Sensor nodes are limited in power, computational capacities, and memory.

• Sensor nodes may not have global identification (ID) because of the large amount of overhead and the large number of sensors.

3.Classification Of Power Conservation Mechanisms For Wireless Sensor Networks

There are many power conservation mechanisms (PCMs) proposed for WSNs, which can be classified into two main categories : active mechanisms and passive mechanisms, as shown in Fig. 1. Active mechanisms refer to those that achieve energy conservation by utilizing energy - efficient network protocols, rather than turning - off the radio (or transceiver) interface of a sensor node, while passive mechanisms refer to those that conserve power by turning - off the radio (or transceiver) interface. Passive power conservation mechanisms can further be classified into three basic categories based on the possible control levels for turning - off the radio interface module:

- Physical - layer power conservation mechanisms.
- MAC layer power conservation mechanisms.
- Higher layer power conservation mechanisms.

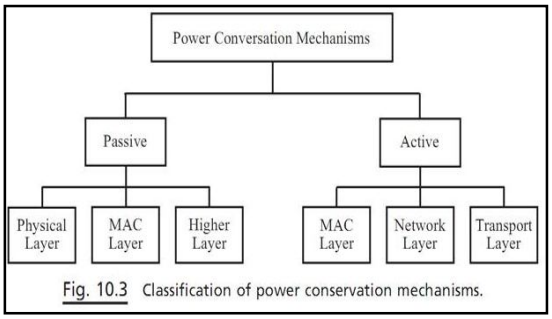

Fig. 10.3 Classification of power conservation mechanisms.

4.Related Work

4.1.Sandip Chaurasiya And Tumpa Pal

Propose an energy-efficient routing scheme called Enhanced Energy-Efficient Protocol with Static Clustering (E3PSC) which is basically a modification of an existing routing scheme, Energy-Efficient Protocol with Static Clustering (EEPSC). Similar to EEPSC, the present work partitions the network into distance-based static clusters. However, unlike EEPSC, cluster-head selection is performed by taking into account both the spatial distribution of sensors nodes in network and their residual energy with an objective to reduce the intra-cluster communication overhead among the nodes making the scheme more energy-efficient. Both Qualitative and quantitative analysis is performed to establish our claim of energy efficiency of the proposed scheme. A set of experiments is carried out to evaluate the performance of the scheme and to compare the results with EEPSC. It has been found that E3PSC outperforms EEPSC in terms of network lifetime and energy consumption.

4.2.Shio Kumar Singh And M P Singh

In this paper, the focus is mainly driven over the survey of the energy-efficient hierarchical cluster-based available routings for Wireless Sensor Network. the radio transmission and reception consumes a lot of energy, one of the important issues in wireless sensor network is the inherent limited battery power within network sensor nodes. Therefore, battery power is crucial parameter in the algorithm design to increase lifespan of nodes in the network. In addition to maximizing the lifespan of sensor nodes, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to maximize overall network performance. Investigating different aspects like, low power protocols, network establishments, routing protocol, and coverage problems

of wireless sensor networks. There are various routing protocols like location-aided, multi-path, data centric, mobility-based, QoS based, heterogeneity-based, hierarchical routing, hybrid routing, etc., in which optimal routing can be achieved in the context of energy.

4.3.Stephanie Lindsey And Cauligi S. Raghavendra

Propose PEGASIS (Power-Efficient Gathering in Sensor Information System),a near optimal chain based protocol that is an improvement over LEACH. In PEGASIS ,each node communicate only with a close neighbor and takes turns transmitting to the base station, thus reducing the amount of energy spent per round. Simulation result show that PEGASIS performs better than LEACH by about 100 to 300% when 1%, 20% ,50%,100% of nodes die for different network size and topologies.

4.4.Shriram Sharma And Ashok Kumar Turuk

Propose an energy-efficient secure routing for wireless networks based on symmetric key cryptography. The proposed crypto system is session based and the session key is changed after the expire of each session. Divided the network into number of clusters and select a cluster head within each cluster. Communication between sensor and the sink takes place at the three levels: sensor- cluster head- sink. Encryption of the sensed data is transmitted to the cluster head, which aggregated the data received from the sensor nodes of its cluster before forwarding to the next cluster head on the path or to the sink . Sensors do not participate in the routing scheme; their energy is conserved at each sensor node.

4.5.Dionisis Kandris And Dimitrios D.Vergadas

Presented the power awareness issue is the primary concern within the domain of Wireless Sensor Networks (WSNs). Most power dissipation occurs during communication, thus routing protocols in WSNs mainly aim at power conservation. Moreover, a routing protocol should be scalable, so that its effectiveness does not degrade as the network size increases. In response to these issues, this work describes the development of an efficient routing protocol, named SHPER (Scaling Hierarchical Power Efficient Routing).

4.6.Mao Ye, Chenfa LI and Jie Wu

Propose a novel energy efficient clustering scheme (EECS) for single-hop wireless sensor networks, which better suits the periodical data gathering applications. This approach elects cluster heads with more residual energy in an autonomous manner through local radio communication with no iteration while achieving good cluster head distribution; furthermore, it introduces a novel distance-based method to balance the load among the cluster heads.EECS prolongs the network lifetime significantly against the other clustering protocols such as LEACH and HEED.

4.7.Mao Ye, Chengfa Li and Guihai Chen

Propose a novel clustering schema EECS for wireless sensor networks, which better suits the periodical data gathering applications. Our approach elects cluster heads with more residual energy through local radio communication while achieving well cluster head distribution; further More, it introduces a novel method to balance the load among the cluster heads. Simulation results show that EECS out performs LEACH significantly with prolonging the network lifetime over 35%.

4.8.Jamal N.Al-Karaki and Ahmed E. Kamal

Present a survey of state-of-the-art routing techniques in WSNs. We first outline the design challenges for routing protocols in WSNs followed by a comprehensive survey of routing techniques. Overall, the routing techniques are classified into three categories based on the underlying network structure: flit, hierarchical, and location-based routing. Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS-based, and coherent based depending on the protocol operation. The design trade-offs between energy and communication overhead savings in every routing paradigm. The advantages and performance issues of each routing technique.

4.9.Osama Younis And Sonia Fahmy

Propose a new energy-efficient approach for clustering nodes in ad-hoc sensor networks. Based on this approach, presented a protocol, HEED (Hybrid Energy-Efficient Distributed clustering), that periodically selects cluster heads according to a hybrid of their residual energy and a secondary parameter, such as node a proximity to its neighbors or node degree. HEED does not make any assumptions about the distribution or density of nodes, or about node capabilities, e.g., location-awareness. The clustering

process terminates in O(1) iterations, and does not depend on the network topology or size. The protocol incurs low over heading terms of processing cycles and messages exchanged. It also achieves fairly uniform cluster head distribution across the network. A careful selection of the secondary clustering parameter can balance load among cluster heads. HEED outperforms weight-based clustering protocols in terms of several cluster characteristics. A simple application to demonstrate its effectiveness in prolonging the network lifetime and supporting data aggregation.

4.10.Wendi B. Heinzelman And Anantha P. Chandrakasan

Develop and analyze low-energy adaptive clustering hierarchy (LEACH), a protocol architecture for micro sensor networks that combines the ideas of energy-efficient cluster-based routing and media access together with application-specific data aggregation to achieve good performance in terms of system lifetime, latency, and application-perceived quality. LEACH includes a new, distributed cluster formation technique that enables self-organization of large numbers of nodes, algorithms for adapting clusters and rotating cluster head positions to evenly distribute the energy load among all the nodes, and techniques to enable distributed signal processing to save communication resources. LEACH can improve system lifetime by an order of magnitude compared with general-purpose multihop approaches.

5.Conclusion

Clustering is a technique to reduce energy consumption and to provide stability in wireless sensor networks. For heterogeneous wireless sensor networks, several clustering protocols are proposed. Most of the recent energy efficient clustering protocols designed for sensor networks are based on residual energy, average energy, location, density etc. which are effective in energy saving. We surveyed energy efficient clustering protocols based on cluster head selection techniques, i.e. probability based and non probability based. We observe that many probabilistic clustering approach lead to variable cluster count and variable cluster size. Table 1 shows the comparison between various clustering protocols used in wireless sensor networks.

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