

Survey on Different Energy Efficient Routing Protocols for Wireless Sensor Network.

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Abstract: The application areas of sensor network are diverse in nature, varying from health monitoring, habitat monitoring, and industrial computing system. They are usually deployed where there is no human intervention. Example, in habitat monitoring the intervention on human may disturb the lifestyle of animals monitored, resulting in wrong interpretation of data. The sensors are battery operated and there is a need for efficient utilization of the resource. The battery utilization can vary with respect to application, network configuration, node deployment or routing algorithm considered. In this paper we do a survey of various routing techniques which aims at increasing the network lifetime by efficiently utilizing the battery resource.

Keywords: Wireless Sensor network, cluster, Tree based, Issues, Recommendation.

I. INTRODUCTION

Wireless sensor networks comprises of large number of sensor nodes. The different components of sensor nodes are: sensing module used for acquiring data from the surroundings, this data is processed locally by a processing module and a wireless module is used to communicate the data to the base station. The nodes are deployed in ad-hoc manner and self organize to form a network. Their applications range in number, to name a few, habitat monitoring, environmental monitoring, industrial monitoring, hospitals etc. In comparison to ad-hoc networks they are more resource constraint, deployed in hostile environment and less mobile. Due to this prolonging the network for longer period of time is challenging as they are battery operated and it is difficult to change or recharge the batteries. The WSN is more prone to network failures due to depletion in energy because, the nodes are irreplaceable. Network connectivity plays an important role to route the data from the area under monitoring to the base station. Traditional approach of assigning of IP address is not possible here because they are large in number. Due to this routing the information in WSN is very challenging that distinguish it from other wireless networks such as MANET or cellular network. An energy efficient routing protocol is required to address these challenges.

The paper is organized as follows: In section 2 details of different issues related to loss of energy of network is considered. In section 3 we present a detail survey on various approaches of energy efficient technique by different researchers. Comparison of different approaches are presented in section 4.

II. ISSUES RELATED TO ENERGY IN WSN:

An important resource in WSN is energy. In order to obtain the phenomenon under observation it is necessary to consume less energy, so that network lifetime is

increased. Energy consumed for communicating, processing query request or forwarding queries or data can be considered as useful usage of energy. The issue here is to avoid wastage of energy which is basically due to

- Idle listening
- Collision
- Over hearing
- Over emitting

Each of these issues has been addressed by different researchers to reduce wastage of energy. In this paper we present various energy efficient routing techniques which minimize utilization of energy with respect to communication.

III. LITERATURE SURVEY

Much research work has been done regarding the different energy efficient routing protocol in wireless sensors network. Several researchers have given several approaches for energy efficient routing. In this paper we give the brief of some of these approaches.

A. Clustering approaches:

Clustering is a technique of dividing the Network into small units so that they can be managed easily. Through clustering energy efficient routing of information can be achieved. Reduction in energy consumption is the main advantage of using clustering based approach. Clustering can improve the scalability of network.

O. Younis et. al[1]. Proposed a Hybrid, Energy-Efficient, Distributed Clustering Approach for Ad Hoc Sensor Network in which Cluster heads are selected probabilistically based on their residual energy and due to nodes join clusters communication cost is minimized. It takes three steps:

In initialization phase each node sets its probability of becoming a cluster head, CH_{prob} is calculated as follows:

$CH_{prob} = C_{prob} * E_{residual} / E_{max}$ where $E_{residual}$ is the estimated current residual energy in the node and E_{max} is a reference maximum energy, Here E_{max} value may vary because sensor nodes supported by HEED are heterogeneous in nature.

In Repetition phase: This phase will be repeated until the CH node was found with the minimum transmission cost. If the appropriate CH cannot be found by nodes, then the concerned node itself was selected as the CH. Lastly The selection of CH is finalized. The tentative CH now becomes the final CH node.

Here a node can be elect to become a cluster head at consecutive clustering intervals if it has low cost and high residual energy.

Recommendation: Proposed algorithm is suitable only for building a two-level hierarchy.

Low-Energy Adaptive Clustering Hierarchy (LEACH) [2] was the first clustering protocol for extending lifetime of network. LEACH works based on node's residual energy and target number of required cluster head. In this paper they have proved that clustering provides 4 to 8 times better network lifetime then direct communication or shortest path routing because energy load is evenly distributed among the sensors in the network.

Recommendation: The drawback of LEACH clustering protocol is direct communication between cluster head and sink that will consume lot of energy leading to reduction in life of cluster head. Multi-layer LEACH-based clustering was an improvement over LEACH which that minimizes the energy consumption throughout the network

All these algorithms cannot handle the situation where the nodes can be moved. DECA protocol handles such problems. The main difference between these two protocols and DECA is how the nodes make such decisions and score gets computed.

In paper [3] an adaptive Clustering architecture for wireless mobile was proposed that can support a multihop mobile network. Here the architecture need not to be a fixed infrastructure, it can be deployed in an environment without infrastructure at all. It can also tolerate mobility because of the robustness of adaptive cluster algorithm. Here nodes are organized into non overlapping clusters. The objective of the clustering algorithm is to partition the network into several clusters. Based On the node ID cluster can be formed here; Nodes can be reached by maximum of two hops paths.

In paper [4] each cluster head had at most k neighbouring cluster heads and an algorithm was proposed to find a maximal weighted independent set in wireless networks.

Research [5-9] has used dominating set based clustering in multi-hop wireless networks. A dominating set is a set of vertices in an undirected graph, if a vertex that is not a part of subset is adjacent to at least one vertex in the subset. The advantage of using dominating set based routing is the simplification of the routing problem to a smaller sub network generated from the connected dominating set.

B. Tree Based approaches:

The PEGASIS protocol is a two step process which includes chain construction and Gathering data.

The chain constructions of the nodes are performed by self organizing of sensor nodes and base station using greedy algorithm. After the nodes self organize themselves, base station broadcast information of the chain to sensor nodes. The node which is away from the Base station is chosen first to ensure that these nodes have close neighbours. The chain gets reconstructed in the same fashion as nodes die by bypassing the dead node. As compared to LEACH here the data fusion is performed at each node excluding the end nodes in the chain whereas in LEACH data fusion happens at cluster head. Each node will fuse its neighbour's data with its own to generate a single packet of the same length and then transmit that to its other neighbour (if it has two neighbours) [11].

Each node senses the data and forwards it to its neighbour. These neighbor nodes receive the data and fuse with its own data and transmits it further in the chain. The advantage here is each node on the chain transmits fused data in turns to the BS which contributes towards saving enormous amount of energy. Another added advantage is that the nodes are chosen randomly to transmit data to BS which results in nodes dying at random locations which increases the robustness of the network.

IV. COMPARISON

TABLE I
COMPARISON OF DIFFERENT ROUTING TECHNIQUES

	LEACH	PEGASIS	DECA
Approach	Clustering	Tree based	Clustering
Working Stages	It has two phases : 1)Set Up Phase 2)Steady phase	It has two phases 1)Chain Construction 2)Gathering data	It has two phases 1)Start Clustering 2)Receive Clustering Message
Head node Selection	Cluster head is selected based on residual energy of the node	Only one node is chosen as head node which sends fused data to base station per round.	Cluster head is selected based on node ID and cluster ID.
Advantage	LEACH is one of the first protocol that use clustering for extending	PEGASIS performs better than LEACH with respect to transmitting distance of	It works for mobile nodes. The algorithm terminates fast, has low computation

	g network lifetime as compared to direct transmission.	each node. The number of messages received by each head node in PEGASIS is less compared to LEACH. Energy dissipation is balanced among sensor nodes in PEGASIS because each node gets selected once.	nal complexity, and generates non overlapping clusters with Good clustering performance.
Disadvantage	In LEACH clustering protocol direct communication between cluster head and sink will consume lot of energy leading to reduction in life of cluster head.	Since only one head node is selected randomly without considering distance between base stations to the head node, this may cause delay in the network. The second drawback is that energy is not considered while selecting head node.	This approach is generally applicable to most multi-hop wireless networks.

V. CONCLUSION

In this paper we have done a literature survey on different cluster based and tree based routing protocols. And come to the conclusion that HEED, LEACH, PEGASIS and DECA aim at increasing the lifetime of the network. The drawback is, these protocols work on nodes which are static and stationary, except for DECA which works on mobile nodes. Also performance of PEGASIS as compared to LEACH and HEED is found to be better as compared in the table. Considering clustering as a parameter DECA proves to be better in comparison to other cluster and tree base approaches. In future we will also build an approach for better energy efficient algorithm.

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