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ENERGY-EFFICIENT CLUSTERING PROTOCOLS FOR WIRELESS SENSOR NETWORKS:A SURVEY

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Abstract : *In Robotics and telecommunications world, wireless sensor networks are an active research area with numerous real life applications, R&D and industrial area. Wireless Sensor Networks consist of small nodes with sensing, computation, and wireless communications capability. Wireless sensor networks (WSNs) have been widely deployed for various applications, such as environment sensing, Military, Medical, Traffic Monitoring, Habitat Monitoring, building safety monitoring, earthquake prediction. In general WSN architecture, storage nodes aggregate data from nearby sensors and answer queries from the sink of the network which is also called as two-tiered WSN architecture. In past many routing, power management, and data scattering protocols have been specifically designed for WSNs, where energy awareness is an essential design concern. In many system data direction-finding in Network Aggregation for WSN's is done by the routing tree finding the shortest path from the source node to sink node while maximizing data aggregation. If one of the nodes failed the repairing route is time consuming and energy consuming process.*

Keywords: *WSN, Clustering, Routing, Harmony Search Algorithm, Two-tired.*

1. INTRODUCTION

Wireless sensor network was initially designed to facilitate military operations, but its application has extensive to health, traffic, and many other consumer and industrial areas. A WSN consists of anywhere from a small to a larger number of sensor nodes.. As such, their prices also rise from a small sum of money to *thousands* of dollars depending on the functional parameters of a sensor like energy consumption, computational speed rate, bandwidth, and memory. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind speed and direction, pressure, etc.

In WSN protocols are usually used for hierarchical organization of the nodes in the network. In fact, the easiest way to combined data flowing from the sources to the sink node is to select some special nodes that work as aggregation points and define a route to be followed when forwarding data. In these protocols, a tree structure is constructed first and then used later to either path the gathered data or respond to queries sent by the sink node. Aggregation is performed during the moving when two or more data packets collect at the same node of the tree. This node, then aggregates all received data with its individual data and forwards only one packet to its neighbor that is lower in the tree. However, this process has some drawbacks. a) When a packet is lost data from the whole sub tree will be lost as well. Thus, tree-based approaches require a method for fault tolerance to reliably forward the aggregated data) In case of link/device failures the cost of maintaining a hierarchical structures increase and the scarce robustness of the system [2].

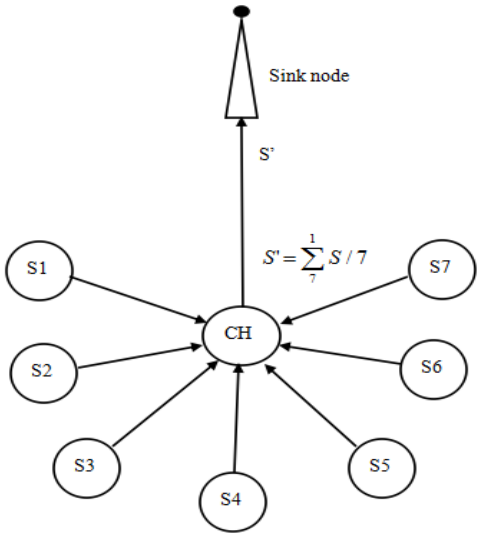

Fig.1: Data Aggregation and Packet Forwarding

Sensor nodes use different data aggregation methods to achieve energy efficiency. The aim is effective communication of all the data to the base station so that the lifetime of the network is maximized in terms of *rounds*, where a round is defined as the process of collecting all the data from sensor nodes to the base station, regardless of how much time it takes [6].

When the hop tree of the sensor nodes to the sink node is create the sink node starts creating the hop tree that will be used by the coordinators for data forwarding. Due to cluster-head selection among the nodes a new event occurs in the network. It is responsible for both setting up a new route for the good delivering of packets and updating the hop tree. However, because this route is unique, any failure occurs route repair mechanism apply which consists of two parts: failure detection at the Next Hop node, and selection of a new Next Hop. If the sender receive its ACK from the Next Hop node, it can infer that the Next Hop node is alive and, for now, everything is ok, but in this for finding the shorted path rout spatial and temporal correlation of the aggregated data will not be taken into consideration as well as the construction of a routing tree that meets application needs.

Paper (Reference number)	Connectivity Of CH To BS	Node Type	Role	Initial Energy	Residual Energy	Energy Consumption Rate	Average Energy Of Network
[11]	Direct Link	Sensor	Relaying	X	✓	X	X
[12]	Direct Link	Resource Rich	Fusion, Relaying	X	✓	X	✓
[13]	Direct Link	Sensor	Aggregation	X	✓	X	X
[14]	Direct Link	Sensor	Aggregation	X	✓	X	X
[15]	Multi -Hop	Resource Rich	Aggregation, Compression	✓	X	X	X
[16]	Multi-hop	Sensor	Aggregation	X	✓	✓	X
[17]	Direct Link	Resource Rich	Aggregation	✓	✓	X	X
[18]	Direct Link	Resource Rich	Relay	X	✓	X	✓

Table 1: Classification of Surveyed Algorithms Based on Clustering Attributes

2. RELATED WORK

[1]. The author DucChinh Hoang proposed a framework that enables practical development of centralized cluster-based protocols supported by optimization methods for the WSNs. Based on this framework, a protocol using harmony search algorithm (HSA), a music-based meta-heuristic optimization method, is designed and implemented in real time for the WSNs. It is expected to minimize the intra-cluster distances between the cluster members and their cluster heads(CHs) and optimize the energy distribution of the WSNs. The study of HSA cluster-based protocol is carried out in a real case where the WSNs equipped with the proposed protocol are deployed in an indoor environment to monitor the ambient temperature for fire detection. A comparison is made with the well-known cluster-based protocols developed for WSNs such as low-energy adaptive.

clustering hierarchy-centralized (LEACH-C) and a cluster-based protocol using Fuzzy C-Means (FCM) clustering algorithm. Experimental results demonstrate that the proposed protocol using HAS can be realized in centralized cluster-based WSNs for safety and surveillance applications in building environments. From the obtained experimental test results, it can be seen that the WSNs life-time has been extended using the proposed HSA protocol in comparison with that of LEACH-C and FCM protocols.

Advantage:

- The goal is to find a balance between the overhead and the quality of the routing tree.
- To increase the data aggregation in wireless sensor networks
- To increase reliability in wireless sensor networks
- Redundant data reduced by Data Aggregation.
- Decreasing communication cost.
- Energy Consumption.

Disadvantage:

- In DRINA location wise routing is not possible.
- If coordinator failed then there is no provision to send aggregated data by other means.

[2]. The author Prof. P. R. Patil proposed a data aggregation framework on wireless sensor networksis presented. The framework works as a middleware for aggregating data measured by a number of nodes within a network. The aim of the proposed work is to compare the performance of TAG in terms of energy efficiency in comparison with and without data aggregation in wireless sensor networks and to assess the suitability of the protocol in an environment where resources are limited.

Advantage:

1.Energy Consumption.
2.Redundant data reduced by Data Aggregation.

Disadvantage:

1.Data loss when one of the nodes fails.
2.High cost of maintaining a hierarchical structure

[3]. The author Rajiv Misra proposed an Ant colony system, a population-based algorithm, provides natural and intrinsic way of exploration of search space in optimization settings in determining optimal data aggregation. The simulation results shows improvement in energy efficiency depends on number of source nodes in sensor network which is 45% energy efficiency using optimal aggregation compared to approximate aggregation schemes in moderate number of source whereas 20% energy efficiency in large number of source nodes. The proposed Ant-Aggregation algorithm is simulated in MATLAB.

Advantage:

1.Schemes improve the system performance.
2.Improve routing efficiency.

Disadvantage:

1.Traffic load unpredictable and unbalance.
2.Hardware overhead cost increase.

[4]. The author B. Baranidharan Assistant Professor proposed an overview of the different routing strategies used in wireless sensor networks and gives a brief working model of energy efficient routing protocols in WSN. We have also compared these different routing protocols base on metrics such as mobility support, stability, overlapping. The study concludes with the recommendations to the future direction in the energy efficiency model for the sensor networks.

Advantages:

1.Using Mobile Computing.
2.Different routing Approaches improve the System performance.

Disadvantages:

1. High Cost.

[5]. The author Vivek Katiyar, proposed Clustering is a key technique used to extend the lifetime of a sensor network by reducing energy consumption (Younis 2003). It can also increase network scalability. Researchers in all fields of wireless sensor network believe that nodes are homogeneous, but some nodes may be of different energy to prolong the lifetime of a WSN and its reliability. In this paper, we study the impact of heterogeneity and survey different clustering algorithms for heterogeneous WSNs; highlighting their objectives, features, complexity, etc.

Advantages:

1. Use of heterogeneous wireless sensor network.
2. More suitable for real time application.

Disadvantages:

1. Heterogeneous wireless sensor networks are more complex than homogeneous ones.

3. CONCLUSION

In this work, algorithm provides fault tolerance coordinator recovering algorithm with spatial and temporal correlation of the nodes also aggregated data will be taken into consideration as well as the structure of a routing tree that meets application needs. Three criteria, including residual energy the number of neighbor nodes and distance of the nodes from base stations are consider in order optimizing the number of clusters/cluster heads. For selecting cluster head considering two parameters that is nodes residual energy and its distance from sink. And cluster is formed with the help other nodes that are in the given radius. So proposed system have low power loss as compared to other two algorithms that is LBC and EEHC.

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