Energy Saving routing Scheme for Information Gathering and Collision Avoidance in Wireless Sensor Network

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Abstract:
Wireless sensor network nodes are very tiny in size and their cost is also not very high. They are deployed in any geographical region in a random fashion. During the process of data sensing, data gathering and data transmission, the charge of the power unit associated with any node gets low, after certain time, i.e., each node has its life time. The life time of nodes directly affects the life time of the sensor network. As each node is very low in cost, it is unnecessary and difficult too, to recharge them once their energies are exhausted. Therefore, it is very important to conserve the power of the nodes so that the life time of the entire network can be conserved. Hence the requirement of a power efficient data gathering protocol is very important to serve the purpose in wireless sensor network. In the paper, we have discussed various routing and cluster based algorithms.

Keywords: *Wireless Sensor Nodes, Information Gathering protocol, Multi-hop Communication*

1. Wireless Sensor Networks

Recent advances in wireless communications and electronics have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate unmetered in short distances. [4] These tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks. Sensor networks represent a significant improvement over traditional sensors. A sensor network is composed of a large number of sensor nodes that are densely deployed either inside the phenomenon or very close to it. The position of sensor nodes need not be engineered or predetermined. [2] This allows random deployment in inaccessible terrains or disaster relief operations. On the other hand, this also means that sensor network protocols and algorithms must possess self-organizing capabilities. Another unique feature of sensor networks is the cooperative effort of sensor nodes. Sensor nodes are fitted with an onboard processor. Instead of sending the raw data to the nodes responsible for the fusion, they use their processing abilities to locally carry out simple computations and transmit only the required and partially processed data. [6] The above described features ensure a wide range of applications for sensor networks. Some of the application areas are health, military, and home. In military, for example, the rapid deployment, self-organization, and fault tolerance characteristics of sensor networks make them a very promising sensing technique for military command, control, communications, computing, intelligence, surveillance, reconnaissance, and targeting systems. [8] In health, sensor nodes can also be deployed to monitor patients and assist disabled patients. Some other commercial applications include managing inventory, monitoring product quality, and monitoring disaster areas.

2. Information Gathering Routing

These types of information gathering protocols are the enhancement over the LEACH protocol. The basic idea of the protocols is that in order to extend network lifetime, nodes need only communicate with their closest neighbours, and they take turns in communicating with the BS. When the round of all nodes communicating with the BS ends, a new round starts, and so on. This reduces the power required to transmit data per round as the power draining is spread uniformly over all nodes. [9] Hence,

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information gathering protocols have two main objectives. First, increase the lifetime of each node by using collaborative techniques. Second, allow only local coordination between nodes that are close together so that the bandwidth consumed in communication is reduced. Unlike LEACH,

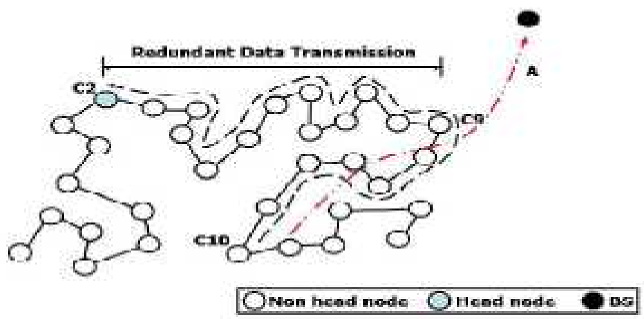

Fig. 1: Information Gathering Protocol Structure [9].

3. PEGASIS

PEGASIS is a basic chain-based routing protocol [9]. In which, all nodes in the sensing area are first organized into a chain by using a greedy algorithm, and then take turns to act as the chain leader. In data dissemination phase, every node receives the sensing information from its closest upstream neighbor, and then passes its aggregated data toward the designated leader, via its downstream neighbor, and finally the base station [8].

Although the PEGASIS constructs a chain connecting all nodes to balance network energy dissipation, there are still some flaws with this scheme. 1) For a large sensing field and real-time applications, the single long chain may introduce an unacceptable data delay time. 2) Since the chain leader is elected by taking turns, for some cases, several sensor nodes might reversely transmit their aggregated data to the designated leader, which is far away from the BS than itself. [10] This will result in redundant transmission paths, and therefore seriously waste network energy. 3) The single chain leader may become a bottleneck.

4. Enhanced PEGASIS

In 2007, Jung et al. proposed a variation of PEGASIS routing scheme, termed as Enhanced PEGASIS [7] (we abbreviate it as EPEGASIS later in this paper). In their method, the sensing area, centered at the BS, is circularized into several concentric cluster levels. For each cluster level, based on the greedy algorithm of PEGASIS, a node chain is constructed. In data transmission, the common nodes also conduct a similar way as the PEGASIS to transfer their sensing data to its chain leader. After that, from the highest (farthest) cluster level to the lowest (near to the BS), a multi-hop and leader-by-leader data propagation task will be followed [9].

The EPEGASIS although has considered the location of the BS to slightly improve the redundant transmission path and the network lifetime, there are still some problems with that scheme. 1) For large sensing areas, the node chain in each concentric cluster would still become lengthy, and thus result in a longer transmission delay. 2) Since the leader node election strategy is same as that in PEGASIS (by taking turns), it did not consider the node’s residual energy [9]. As a node with the least residual energy is elected to act as the leader, the network lifetime would be significantly affected. 3) While the distribution of sensor nodes is not even, the transmission distance between two chain-leaders in different cluster levels might be lengthy, this would consume more energy.

5. Enhanced Chiron

The operation of CHIRON protocol consists of four phases: 1) Group Construction Phase. 2) Chain Formation Phase. 3) Leader Node Election Phase 4) Data Collection and Transmission Phase.

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Instead of using concentric clusters as EPEGASIS scheme does, the CHIRON adopts the technique of Beam Star [9] to organize its groups. After the sensor nodes are scattered, the BS gradually sweeps the whole sensing area, by successively changing different transmission power levels and antenna directions, to send control information (including the values of R and θ) to all nodes. After all nodes receiving such control packets, they can easily determine which group they are respectively belonging to. In addition, by the received signal strength indication (RSSI), every node can also figure out the value of *dis* (*ni*, *BS*). [9]

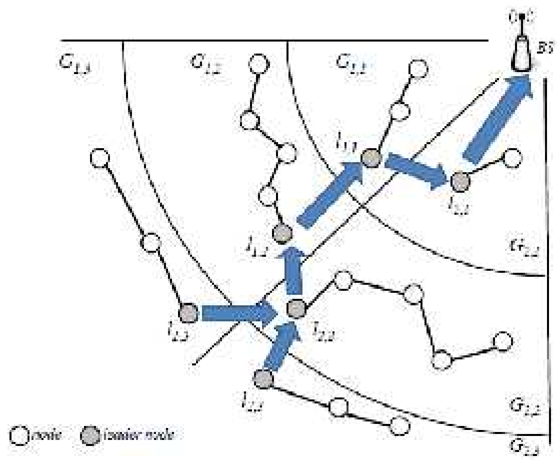

Fig 1: The data transmission flows in Enhanced Chiron

For data transmission, a leader node in each group chain must be selected for collecting and forwarding the aggregated data to the BS. Unlike the PEGASIS and EPEGASIS schemes, in which the leader in each chain is elected in a round-robin manner, CHIRON chooses the chain leader (lx,y) based on the maximum value Res(ni) of group nodes. Initially, in each group, the node farthest away from the BS is assigned to be the group chain leader. After that, for each data transmission round, the node with the maximum residual energy will be elected [11]. The residual power information of each node ni can be piggybacked with the fused data to the chain leader lx,y along the chain cx,y, so that the chain leader can determine which node will be the new leader for next transmission round.

6. Comparison of Protocols

Comparison analysis of the information gathering protocols based on chain information passing has been done and it is found that Enhanced Chiron has better performance than other chain based information gathering protocol. It is shown in Fig 2.

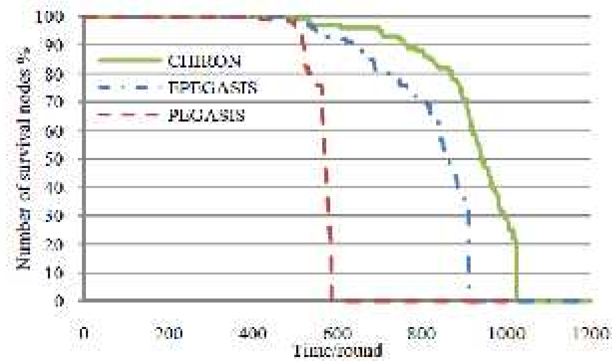

Fig 2: Performance analysis of various protocols

7. Conclusion

In this paper, we have done analysis for performance evaluation of various chain based information gathering protocol. Various protocols has been evaluated on bases of energy consumption. In our future work we will provide better information gathering routing for improvement.

References

[1] Subhankar Mishra, Sudhansu Mohan Satpathy, and Abhipsa Mishra, “LEAD: Energy Efficient Protocol forWireless Ad Hoc Networks”, CCSIT @ Springer-Verlag Berlin Heidelberg, Part II, CCIS 132, pp. 99–106, 2011.

[2] K.Suganthi, Dr.B.Vinayaga Sundaram ,K.S.Vishwa Kumar, J.Syed Ashim,S.Saravana Kumar,”Improving Energy Efficiency and Reliability using multiple mobile sinks and hierarchical clustering in Wireless Sensor Networks”, IEEE-International Conference on

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Recent Trends in Information Technology, ICRTIT IEEE, MIT, Anna University, Chennai. June 3-5, 2011.

[3] Jun Chang, Jiang Yu, Juan Ke and Jingsong Hu, "Simulation of worst and best case coverage for wireless sensor network", 2010 International Conference on Information, Networking and Automation (ICINA), Kunming, IEEE, Vol. 3, Issue. 7, 2010, pp. 291-295.

[4] Elham Hajian, Kamal Jamshidi, Ali Bohlooli, "Increasing WSN lifetime by using learning automata for optimal route selection", 2010 International conference on Information, Networking and Automation(ICINA),Kunming, 2010,IEEE, pp. 215-218

[5] K.Sheela Sobana Rani," Energy Efficient Approach for Collision Avoidance in Wireless Sensor Networks", Journal of Information Engineering and Applications, Vol 2, No.3, 2012.

[6] Shih-Hao Chang, Madjid Merabti, Hala Mokhtar, "A causal model method for fault diagnose in wireless sensor networks", 2010 10th IEEE International conference on Computer and Information Technology (CIT 2010), Bradford, IEEE, pp.155-162.

[7] Wei Ni, Wendong Xiao, Yue Khing Toh and Chen Khong Tham, "Fingerprint-MDS based algorithm for indoor wireless localization",21st Annual International symposium on personal, indoor and mobile radio communications, Istanbul, 2010,IEEE, pp.1972-1977 .

[8] K.Becher, C.P.Figueiredo, C.Muhle, R.Ruff, P.M.Mendes and K.P.Hoffmann, "Design and realization of a wireless sensor gateway for health monitoring", 32nd Annual International conference of the IEEE EMBS Buenos Aires, Argentina, August31-September 4, 2010,IEEE, pp.374-377 .

[9] Kuong-Ho Chen, Jyh-Ming Huang, Chieh-Chuan Hsiao, "CHIRON: An Energy-Efficient Chain-Based Hierarchical Routing Protocol in Wireless Sensor Networks", WTS'09 Proceedings of the 2009 conference on Wireless Telecommunication Symposium, IEEE press Piscataway, NJ, USA, September 2009, IEEE, pp. 1-5.

[10] N. Vlajic, D. Stevanovic, "Performance Analysis of ZigBee-based Wireless Sensor Networks with Path-Constrained Mobile Sink(s)", 2009 Third International Conference on Sensor Technologies and Applications, 2009.

[11] S. Lindsey, C. S.Raghavendra, and K. M. Sivalingam, Data Gathering Algorithms in Sensor Networks Using Energy Metrics," IEEE Transactions on Parallel Distributed System, Vol. 13, Issue. 9, pp. 924- 935, 2002.

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