Impact factor 1.472

"International Journal for Science and Emerging Technologies with Latest Trends" 13(1): 31-35 (2013)

ISSN No. (Online):2250-3641
ISSN No. (Print): 2277-8136

A Survey on Power Management Techniques in Wireless Sensor Network

Jatinder Pal Singh* and Love Kumar**

*Research Scholar, Department of ECE, DAVIET
**Assistant Professor, Department of ECE, DAVIET
Jalandhar, India

(Received 7 November 2013 Accepted 17 November 2013)

Abstract-A Wireless Sensor Network (WSN) is an ad-hoc network. In Wireless Sensor Network the number of nodes which are organized into a cooperative network. WSN is a network that contained battery-powered nodes which route the data from source node to sink. Each node consumes energy in order to transmit or receive the data on its radio. Therefore, power management is a major issue for wireless sensor network. A survey is presented in this paper on power management considers various routing schemes to maximize the efficiency of WSNs.

Keywords-Power Management, MLRP, DSDV, DSR, MREP, Routing, and Sensor Networks

1. INTRODUCTION

A Wireless Sensor Networks (WSN) may be described as a network of small, autonomous, battery-powered nodes and routed to a sink, which typically lacks energy constraints. If some sources do not coordinate their routes to sinks, it is possible that one or more nodes may be exhausted due to overuse and the network may be partitioned .When this occurs, the energy in sources that are disconnected from sinks that is wasted of energy and there is no mean to route the data. Consider the network shown in Fig.1.It consists of ten nodes out of which three nodes are sources and one node is a sink (Z). An edge between two nodes indicates that those nodes can communicate with other, assumed that communication is bidirectional. Within the network, it is obvious that certain nodes consume more power to maintaining connectivity than others.

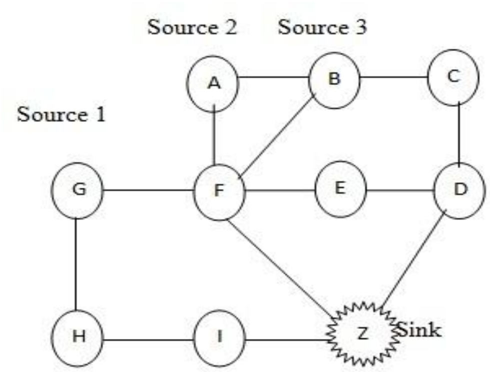

Figure 1.Wireless Sensor Network

Each *source* determines the optimal path routing to a *sink* .For example, the optimal routes to the sink might be GFZ from source G, AFZ from source A and BFZ from source B. However all the above routes require the use of node F. To reducing the energy expenditure of node F, it is require source G to use the non-optimal route GHIZ.

2. RELATED WORK

A number of routing schemes have been proposed that attempt to maximize the efficiency of WSNs. Although many schemes are derived from a combination of others, they can be loosely grouped into the categories of minimum hop routing, minimum energy routing, loading balancing routing and potential based routing.

2.1 Minimum Energy routing

Since the energy required for transmission and the transmission distance, a longer sequence of small hops may require less energy than a short sequence of long hops. Minimum energy routing seeks to use (source, sink) paths least energy expenditure.

In Multi-stage data routing protocol (MLRP) [9], when an RREQ message is sent from a source, it specifies a minimum transmission power that must be used. Any node received an RREQ retransmits it at the power specified in the message. After some period of time, if the source has not received an RREP, it increases the transmission energy and resends the RREQ. The protocol therefore returns the minimum hop path of least energy. Although MLRP assumes directionality, the proposal of using an incremental transmission power can be applied to virtually any other routing protocol. However, MLRP encourages the global use of nodes with transmission energies. For example, if the transmission cost of F to Z in Fig. 1 is small then the use of node F is encouraged, even though its loss would disconnect source A. It could be argued that since F’s transmission power is low, it will take much longer to expire. However node F may only be fractionally cheaper than some alternative. Furthermore if every source routes through node F, it may still expire very quickly.

2.2 Minimum hop routing

Minimum hop routing selects a path based on the minimum number of hops necessary to reach a sink. The oldest minimum hop routing protocol is Dynamic Destination Sequence Distance Vector Routing (DSDV) [1], later superseded by Ad Hoc On-demand Distance Vector Routing (AODV) [2][15] which forms routes on demand rather than proactively. Both protocols operate similarly. A route request(RREQ) message, containing a sequence number, the source from which the message originated and the number of nodes through which the message has travelled, is flooded through the network. Eventually, some node that has a path to the destination or is the destination receives the message, and that node responds with a route reply (RREP), which is routed back through the network. Each node forwards the RREP to the node from which it received the original RREQ. Since each RREP message is required to travel the same path as the corresponding RREQ, but in reverse, AODV and DSDV both require bidirectional edges.

In Dynamic Source Routing Protocol (DSR) [3], all RREP messages contain the sequence of nodes through which they have travelled. The RREP is encapsulated in its own RREQ so that a path can be discovered from the sink back to the source, and that contains the sequence of nodes originating from the source. Since the RREP is flooded. There is no requirement for the edges to be bidirectional. Therefore route discovery requires two floods per (source, sink) pair. RREQ and RREPs must also carry a sequence of node identities rather than a simple hop count. These two features combine to limit the scalability of protocols such as DSR.

In [4-7] it has been suggested that minimum hop routing is prone to be a number of disadvantages. Firstly, minimizing the number of hops encouraged the use of nodes that are geographically distant [4]. Since energy expenditure is argued to be proportional to either the second [5] or fourth powers [8] of the distance, long hops either requires more energy or are less reliable for fixed amount of energy. Secondly, it has been suggested that the use of minimum hop routing (and more generally shortest path routing of which minimal hop is an example) causes a subnet of nodes to expire more quickly [6, 7], potentially disconnecting sources from sinks. For example in Fig. 1, the use of minimum hop routes from A and G (AFZ and GFZ) would cause F to expire quickly and disconnect A from Z.

2.3 Potential Based routing

Power aware multicast routing protocol (PMRP) [12] aims to limit path maintenance overhead on node failure. Each node carries a score initially based on its distance (in hops) from a sink. Data is always routed to the neighbor with the lowest score. If such a node cannot be found, for example after a failure, a widening search is conducted for a node of lower score. When such a node is found, scores of nodes on the path to the discovered node are lowered. Adjusting the scores in this manner ensures that other routes to the sink are not disrupted and allows new paths to be formed using only a subset of local nodes. Unlike our proposed routing scheme, PMRP does not actively encourage lifetime extension or the preservation of particular nodes

2.4 Load balancing routing

Load balancing routing distributes the routing workload across as many nodes as possible, even if the path chosen by sources are not optimal with respect to the energy consumption. The Maximum residual energy path (MREP) [10] routing protocol works by selecting the path whose node of least remaining energy is the greatest (the maximum minimum element).

In MREP, the cost of a node is inversely proportional to the remaining energy of that node and the lowest lexicographically ordered path is used. Lexicographically comparing two paths P and Q involves an examination of the highest cost node on each path. The path whose highest cost node has the lowest cost lexicographic order. If the nodes of equal cost, the next highest cost nodes are examined, and so on Load balancing routing suffers from two disadvantages. Firstly, it is difficult to determine the remaining energy on each node. Secondly distributing the routing workload might cause additional energy expenditure.

In order to provide an accurate approximation to the amount of energy stored in a node, Lin [11] proposes the energy of nodes using discrete energy levels. Using this technique, a four-level logarithmic scale is proposed with level 0 corresponding to full energy, level 1 between half and full energy, level 2 between quarter and half energy, and level 3 between one eighth and zero energy. Whilst this reduces the overhead associated with load balancing, routes are required to be recalculated when any node changes its energy level. Load balancing typically puts off the time until first node expiration by distributing workload. However, this approach does not necessarily reduce the wastage of energy of sources since it may be to the detriment of the entire networks' energy.

3. COMPARISION

The table no.1 gives the comparison between Minimum Energy Routing, Minimum Hop Routing, Potential Based Routing and Load Balancing Routing techniques against their advantages and disadvantages.

Table No.1 COMPARISION

S.No.	Types of Routing	Advantages	Disadvantages
1	Minimum Energy Routing	Requires less energy for transmission with small hopes.	Quickly expire the intermediate node.
2	Minimum Hop routing	Shortest path for routing used.	Quickly expire the intermediate node.
3	Potential Based Routing	In case of node failure, new paths are formed.	It does not encourage lifetime extension of particular nodes
4	Load balancing routing	The routing workload across the nodes in distributed manner.	Evaluation of remaining energy on each node is difficult.

From the above comparison we have concluded that all above mentioned routing techniques having different advantages and disadvantages, out of this Load Balancing Routing technique have additional advantages against other routing techniques. It also trade-off why choosing a routing technique depending upon the application of Wireless Sensor Network.

4. CONCLUSIONS

This paper has examined mechanisms for reducing the power consumption on source node in a WSN when routing data from source node to sink node. Common routing protocols mat not be capable of resolving the problem. In the possible future work merging features from other routing protocols so that scalability of the WSN could be improved.

REFERENCES

[1] C. E. Perkins and P. Bhagwat , "Highly Dynamic Destination- Sequenced Distance –Vector Routing (DSDV) for Mobile Computers," ACM SIGCOMM Computer Communication Review, vol. 24, pp.234-244,1994.

[2] C. E. Perkins and E. M. Royer,(1999) "Ad-hoc On –Demand Distance Vector Routing ," in Proceedings of the Second IEEE Workshop on Mobile Computer Systems and Applications, Orleans , USA , pp. 90-100.

[3] D. B. Johnson, et al., (2000) "DSR: The Dynamic Source Routing Protocol for Multi-hop Wireless Ad hoc Networks, "in Ad hoc Networking, C.E. Perkins, Ed., ed: Addison – Wesley, pp. 139-179.

[4] A. Woo , et al., (2003) "Taming the Underlying Challenges of Reliable Multi hop routing in sensor networks, "in Los Angeles, California , USA, Conference on Embedded Networked Sensor System, pp. 14-27.

[5] W. R. Heinzelman , et al .,(2000)"Energy-Efficient Communication Protocol for Wireless Micro sensor Networks, "in 33rd international Conference on system Sciences, Hawaii, USA, pp. 548-552.

[6] H. Dai and R. Han, (2003) "A Node – Centre Load Balancing Algorithm for wireless sensor Networks," in IEEE GLOBECOM – Wireless Communication, San Francisco, USA, pp.548-552.

[7] S. Singh, et el., (1998) "Power-Aware Routing in mobile Ad Hoc Networks, " in Mobile Computing and Networking, Dallas, Texas, United States, 1998,pp. 181-190.

[12] D. Y. Kwon, et al., (2009) "A Potential Based Routing Protocol for Mobile Ad hoc networks," presented at the 11th IEEE International Conference on high Performance Computing and Communication, Seoul, Korea, 2009.

[13] I. Stojmenovic, et al., (2005) "Design Guidelines for Routing Protocol in ad hoc and sensor networks with a realistic physical layer," IEEE Communication Magazine, Vol. 43, pp.101-106, 2005.

[14] A. W. F. Boyd, et al., "On the Selection of Connectivity –based Metrics for WSNs using a Classification of Application Behaviour," in IEEE International Conference on Sensor Networks, Ubiquitous and Trustworthy Computing, Newporn Beach, California, USA,.

[15] M Pandey and S. Verma,(2011) "Performance Evaluation of AODV for different Mobility Conditions in WSN," International Conference on multimedia, Signal Processing and Communication Technologies, pp.240-243 IEEE 2011.

[8] G. J. Pottie and W.J. Kaiser, (2000) "Wireless Integrated Network Sensor," Communications of the ACM, vol. 43, pp. 51-58,

[9] B. Zhang and H. T. Mouftan, (2006) "Energy-aware on – demand routing protocols for wireless ad hoc networks," Wireless Networks, vol. 12, pp. 481-494.

[10] J.-H Chang and L. Tassiulas, (1999) "Routing for Maximum System Lifetime in Wireless Ad hoc Networks," in 37th Annual Allertron Conference on Communication, Control and Computing, Monticello, IL, 1999.

[11] L. Lin, et al., (2005) "Asymptotically Optimal Power aware routing for multihop Wireless Ad-hoc Networks with Renewable Energy Sources," in 24th Joint Annual conference of the IEEE Computer and communications Socities, Miami, FL, USA, pp.1262-127

[16] I.F. Akyildiz W.Su, Y. Sankarasubramaniam, and E. Cayirci, (2002) "A survey on sensor networks," IEEE communications Magazine, pp. 102-11.

Impact factor 1.472