

Flat Based Network Routing protocol in Wireless Sensor Network

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Abstract: A wireless sensor networks (WSNs) consists of the spatially distributed autonomous sensors that are used to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location where the further actions could be taken. These networks are built using nodes that may range from few to several hundreds. The different aspects and techniques that would be involved in the deployment of these networks are such as routing, lifetime of the nodes and network, communication between nodes and base station etc., which are to be decided based on the applications the sensors would be used. This paper specifies about the different routing techniques that can be used in wireless sensor networks and specifically gives the information about the energy efficient routing techniques that is the part of the flat based routing method.

Keywords: wireless sensor networks, routing protocols, flat based routing.

1. INTRODUCTION

Wireless networks are an emerging new technology that will allow users to access information and services electronically, regardless of their geographic position. When many sensors cooperatively monitor large physical environments, they form a wireless sensor network (WSN). The applications [1], [3] of WSNs are broad, like weather monitoring, field police work, temperature, humidity, vehicular movement, lightning condition, pressure, soil makeup, noise levels inventory and producing processes, etc.

Initial deployment of sensor nodes must be checked such that it reduce the installation cost, eliminate the need for any pre-organization and pre-planning, increase the flexibility of arrangement, promote self-organization and fault tolerance.

The routing protocols can be classified based on different methods [1], [3] such as Initiator of Communication that is based on source and destination, network structure further classified as flat, hierarchical, or location-based, Path Establishment further classified as proactive, reactive and

hybrid, Protocol Operation classified as query based, Qos based, multipath based, Query based, coherent and non-coherent, next hop selection classified as broadcast based, hierarchical, location based, probabilistic, content based. This paper explores in detail about different network structure based protocols that are flat networks where all nodes play the same role while hierarchical protocols aim at clustering the nodes so that cluster heads can do some aggregation and reduction of data in order to save energy. Location-based protocols employ the position information to relay the data to the desired regions rather than the whole network. This paper, discuss the routing techniques in WSNs that have been developed in recent years and develop a classification for these protocols. Then each of the routing protocols under this classification is discussed. Our goal is to provide deeper understanding of the current routing protocols in WSNs.

2 ROUTING PROTOCOLS

The different routing protocols that can broadly segregated into [1] network structure based routing protocol, where the structure of the sensor network plays the crucial role and the other method is protocol operation, where it is based on protocols, queries, negotiation, coherent and quality of service.

2.1 Network Structure based routing protocol

Network Structure based routing protocol could be divide into three main structures i.e., flat based, location based and hierarchical based routing. Figure 2.1 gives the idea of the flat based and hierarchical based routing network structure. The upmost session discuss about the flat based routing and different example of this method.

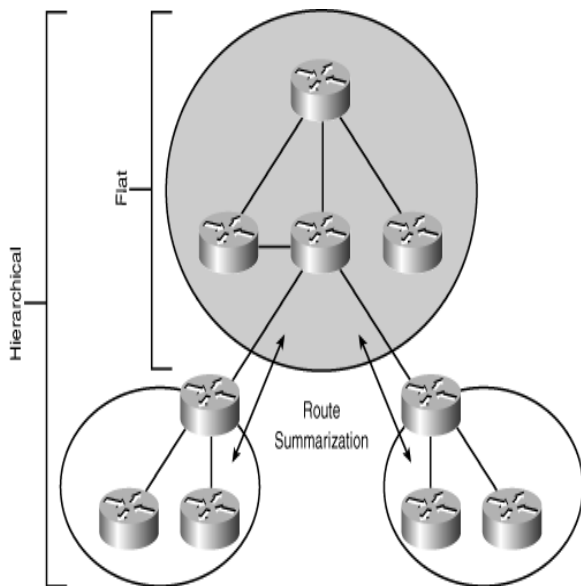


Fig 2.1: flat based routing and hierarchical based routing

2.1.1 Flat based routing

Flat based routing is where all nodes will participate equally in the functionality and plays a similar role; hence it is not feasible to assign the global identifier to all nodes. This as lead to the routing known as data centric or attribute centric, it is where the base station sends the query to the certain area and waits until the sensor node in that location reply's with the data [1],[5].

Some of the examples of this protocol are

- direct diffusion
- sensor protocol for information via negotiation
- energy aware routing
- minimum cost forwarding algorithm
- active query forwarding in sensor network

2.1.2 Direct diffusion (DD)

It is one of the mostly used and popular data centric methods which were proposed by Ramesh Govindan et al. [2]. Data centric is where which work as an application aware method, it allows to select the empirically best path which saves the energy by also caching and processing the data in-network [1] that is it combines the data from different sources by eliminating the redundancy and minimizes the number of transmissions. As it is the data centric method there is no need for the addressing mechanism as all communication is neighbor-to-neighbor. Direct diffusion [2] method is one of the high energy efficient as there is no need for maintaining the global network topology.

The different stages [7] of the direct diffusion method are propagation of the interest, setup of gradients and data dissemination. Interest can be described as the task that is required to be done by the network. Interest would be sent hop-by-hop through the network and would be broadcasted by each node to its neighbors. Sensor would later measure the events and create the gradients of information that is base station may send query for data by disseminating interest and intermediate nodes propagate these interests.

The disadvantage of this method is that it cannot be used in those application which may require continues data delivery to the base station.

2.1.3 Sensor protocol information via negotiation (SPIN)

SPIN is the one among the earliest method under data centric routing. It works on the mechanism of naming the data running in the nodes using the high level descriptors i.e., meta-data. These meta-data are that information that is to be exchanged among the sensors through methods such as data advertisement mechanisms; this would help the nodes to negotiate with each other before transmission helping to avoid the redundant data. The denotation of the meta-data is user specific and is not given by the SPIN. Advantages of SPIN are that the sensor nodes work effectively in energy conservation by sending data that only describes the sensor data instead of sending all the data. This overcomes the drawbacks of the conventional methods such as flooding or gossiping based routing protocols. few drawback of SPIN method are: it doesn't guarantee the delivery of the data to target node and is not suitable for high density distribution of nodes, and if the target node is far from the source node and if the intermediate nodes are not interested of the transmitted data then the data would not be delivered to the target node at all.

2.1.4 Minimum Cost Forwarding Algorithm (MCFA)

MCFA is an effective method which is most appropriate for a wireless sensor network with limited resources [11]. MCFA aims to deliver the message between the sensor nodes and base station using the minimum cost path. It is not necessary to maintain the routing table or to have a unique ID to the sensor nodes as the direction of the routing is always known towards the based station that is fixed. When any sensor node receives the message it checks if it continues on the least cost path towards the base station, if so it re-broadcasts the message to its neighbors until base station receives the message. The minimum cost indicates the optimal path from source to destination node. The cost of the link can calculated simply as hop count, an energy consumed, a delay between source and sink.

The advantage [12] of this method is its simplicity as it can be used with nodes having less memory or processing speed.

2.1.5 Energy aware routing (EAR)

Energy aware routing is an efficient method used to reduce the energy consumption of the wireless sensor network to increase the network lifetime [4]. This method maintains a set of paths rather than single path like other methods, where these paths would be selected based on certain probability. The protocol makes use of the localized flooding method to discover the routes between source and destination and their costs and builds the routing tables. The paths with greater cost are discarded and forwarding table is built based on neighbor nodes and their costs.

There are different techniques that incorporate this routing protocol where Energy Aware Sink Relocation (EASR) [6] method is an example. EASR is a method which uses

energy aware transmission range adjusting method where the transmission range would be adjusted based on the residual battery energy of the sensor nodes. The maximum capacity path routing would be used in this technique as both methods make use of the energy level of the sensor nodes as the prime consideration.

2.1.6 Active QUery forwarding In sensoR nEtwork (ACQUIRE)

ACQUIRE [13] is a method which sees the network as a distributed database which consists of the complex queries that would be further divided into sub queries. The basic idea behind this method is that the base station generates and sends the query which would be forwarded to each node receiving the query [8]. As the query is progressed through the network it would be resolved into smaller query until it is completely solved. Once the query is solved it would be sent back to the base station via the reverse or the shortest path.

All the above discussed methods have their own advantage and disadvantages which has been briefed in the table 1, by comparing them based on different considerations such as network lifetime, optimized path selection, resource usage and awareness and usage of the meta-data.

	DD	SPIN	MCFA	EAR	ACQ-UIRE
Network lifetime	Good	Good	Good	Very good	Good
Optimized path	Yes	No	yes	Yes	Yes
Resource awareness	Yes	Yes	yes	Yes	No
Use of meta-data	Yes	Yes	No	Yes	Yes

Table 1: comparison between different methods

3 CONCLUSION

Routing is an important aspect in the sensor network which is a newly emerging field in research. There are various techniques of routing in wireless sensor network as mentioned in the beginning of the work. This paper makes an effort of introducing few such protocols focusing mainly on the flat based method and the different techniques under this method.

REFERENCES

1. Jamal N. Al-Karaki and Ahmed E. Kamal, "Routing Techniques in Wireless Sensor Networks: A Survey", Telecommun. Syst., Aug. 2013.
2. C. Intanagonwiwat, R. Govindan, and D. Estrin, "Directed diffusion: a scalable and robust communication paradigm for sensor networks", Proceedings of ACM MobiCom '00, Boston, MA, 2000, pp. 56-67.
3. Neha Rathi, Jyoti Saraswat and Partha Pratim Bhattacharya, "A Review On Routing Protocols For Application In Wireless Sensor Networks", International Journal of Distributed and Parallel Systems (IJDPSS) Vol.3, No.5, September 2012.
4. Backhyun Kim and Iksoo Kim, "Energy Aware Routing Protocol in Wireless Sensor Networks", IJCSNS International Journal of Computer Science and Network Security, VOL.6 No.1, January 2006.
5. Hussein Mohammed Salman, "Survey of routing protocols in wireless sensor networks", International Journal of Sensors and Sensor Networks 2014; 2(1): 1-6, January 20, 2014.
6. M.Vivek and R.Illayaraja, "Sink Relocation For Network Lifetime Enhancement Method In WSN", International Journal of Modern Trends in Engineering and Research, e-ISSN: 2349-9745, 2014.
7. Jyoti Saraswat, Neha Rathi and Partha Pratim Bhattacharya, "Techniques to Enhance Lifetime of Wireless Sensor Networks: A Survey", Global Journal of Computer Science and Technology Network, Web & Security Volume 12 Issue 14 Version 1.0 Year 2012.
8. Narayanan Sadagopan, Bhaskar Krishnamachari and Ahmed Helmy, "Active query forwarding in sensor networks", Ad Hoc Networks 3 (2005) 91–113.
9. Kemal Akkaya and Mohamed Younis, "A Survey on Routing Protocols for Wireless Sensor Networks", 2004
10. R Vidhyapriya And Dr P T Vanathi, "Energy Aware Routing for Wireless Sensor Networks", January 03, 2007.
11. M.Chithik Raja, "The Minimum Cost Forwarding Using MAC Protocol for Wireless Sensor Networks", International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.6, Nov-Dec. 2012 pp-4122-4127.
12. William D Henderson and Steven Tron, "Verification of The Minimum Cost Forwarding Protocol for Wireless Sensor Networks", 2006.
13. Narayanan Sadagopan, Bhaskar Krishnamachari and Ahmed Helmy, "Active Query Forwarding in Sensor Networks (ACQUIRE)", June 11, 2003.