Survey of Routing Protocols in Wireless Sensor Networks

Ozair Ahmad

M.E Scholar, Department of ECE National Institute of Technical Teacher's Training & Research UTI, Chandigarh

Abstract- WSN is one of the most commonly used communication tools. It is used in many areas of life for both civilians and militaries purposes. These network comprises of small size sensor nodes with sensing, computation and wireless communications capability. The sensor nodes communicate together by many wireless strategies. These communication strategies are administrated by routing protocols. There are different types of routing protocol. Classically most routing protocols can be classified as datacentric, hierarchical and location-based protocols depending on the network structure and application. This paper deals with the availability and reliability of each class of these routing protocols.

Key Words: Protocol, Routing, Sensor, Wireless Communication, Wireless Sensor Network (WSN)

I. INTRODUCTION

Wireless Sensor Network (WSN) is considered as one of the most powerful technology of 21st century [1]. Wireless sensor networks are intended for monitoring an environment. The main task of a wireless sensor node is to sense and collect data from a certain domain, process itand transmit in to the sink where the application lies. However, ensuring the direct communication between a sensor and the sink, may force nodes to emit their message with such high power that their resources could be quickly depleted.

Wireless Sensor Network (WSNs) is an architecture of sensor networks. WSN can be formed by sensor in ad-hoc manner. 1990s there was an important shift of sensor network research due to advances in computing and communications, small size, low cost sensor are designed to be based upon MEMS technology, works networking and low power processor, which make sensor possible to be deployed in a wireless fashion.

II. COMPONENTS OF WSN

The main components of a general WSN are the sensor nodes, the base station (BS) and events being monitored. Where the communication among the nodes is low-power wireless link while communication between the base station low latency and higher bandwidth link as shown in Fig.1.



Fig.1. Representative sensor network architecture

As shown in Fig.2, a sensor node is composed of four basic components: sensing unit, processing unit, transceiver unit and power unit.





III . ROUTING CHALLENGES AND DESIGN ISSUES IN WSN

One of the main design goals of the WSNs is to carry out data communication while prolonging the life of the network. The design issue of routing protocols in WSNs is influenced by many challenging factors. These factors must be overcome before efficient communication can be achived in WSNs [3]. We summarize some of the routing challenges and design issue that effect routing process in WSNs.

- (1) Node deployment
- (2) Data routing model
- (3) Node heterogeneity
- (4) Fault tolerance

- (5) Scalability
- (6) Data aggregation

IV. ROUTING PROTOCOLS IN WSNs

Routing protocols in WSNs can be divided into datacentric, hierarchical and location based protocols depending on the network structure and application. A few distinct protocols are based on network flow and quality of service (QoS). Data-centric protocols are querybased and depend on the naming of data of interest, which could help to reduce repeated transmission. Hierarchical protocols use the cluster concept in the network to divide sensor into different cluster and choose cluster heads to aggregate and reduce transmission of data in order to save energy. Location -based protocols utilize the position information relay data to the destination. A routing protocol is considered adaptive if certain system parametrs can be controlled in order to adapt to the current network conditions and available energy levels. In addition to the above, routing protocols can be classified into three categories, namely proactive, reactive and hybrid protocols depending on how the source find a route to the destination. Fig.3. shows the classification of WSN routing protocols.



Fig.3. Classification of routing protocols in WSN

DATA-CENTRIC PROTOCOLS: It is not feasible to assign global identifiers to each node due the sheer number of nodes deployed in many application of sensor networks. The data is usually transmitted from every sensor node within the deployment region with significant redundancy. Thus routing in the system should operate autonomously, changing its configuration as required. This means protocols are able to select a set of sensor nodes and can employ data aggregation during the delivery while considering energy consumption. This leads to data-centric routing approach in which base station sends query to a group of particular nodes in a region and waits for response. Examples of data-centric routing protocols are:

(1) Energy Aware Routing (EAR)

(2) Sensor Protocols for Information via Nagatiation (SPIN)

(3) Flooding and Gossiping

HIERARCHICAL - BASED ROUTING: When network scalability and efficient communication is required, hierarchical-based routing is the best option. It is also called cluster based routing. Hierarchical-based routing is energy efficient method in which high energy node randomly selected for processing and sending data while low energy nodes are used for sensing and sending information to the cluster heads. In addition, the rest of sensor in that cluster can perform tasks of sensing. Hierarchical routing works in two steps, first step used to choose cluster heads and the second stepis used for routing. It increases the overall system scalability, lifetime and energy efficiency. Examples of hierarchical-based routing protocol:

(1) Low Energy Adaptive Clustering Hierarchy (LEACH)

(2) Threshold Sensitive Energy Efficient Sensor Network Protocol (TEEN)

(3) Power Efficient Gathering in Sensor Information System (PEGASIS)

(4) Minimum Energy Communication Network (MECN)

LOCATION-BASED ROUTING: In this kind of routing, sensor nodes are addressed by means of their location. They are located mostly by means of GPS. The distance between nodes is estimated by the signal strength received from those nodes and coordinates are calculated by exchanging information between neighboring nodes. Moreover the discovery of sensor node is ascertained directly through communication satellite, applying Global Positioning System (GPS) when sensor nodes are filled with a low power GPS receiver. In some application information of the sensor area is known, so using locations of sensor can build a query directly diffused only to region of interest, and decrease the number of transmission significantly. Locatio- based routing networks are:

- (1) Sequantial Assignment Routing (SAR)
- (2) Greedy Other Adaptive Force Routing (GOAFR)
- (3) Geographic Adaptive Fidelity (GAP)
- (4) Energy Aware Greedy Routing (EAGR)

According to protocol operation, routing protocols can also be classified into multipath-based, query-based, negotiation-based, and network flow and QoS-based. IJLTEMAS

MULTIPATH ROUTING PROTOCOLS: As its name implies, protocols included in this class provide multiple path selection for message to reach destination thus decreasing delay and increasing network performance. When the primary path fails between the source and destination an alternate path exists that measures the fault tolerance of a protocol. This increases the cost of energy consumption and traffic generation. Also the overhead of maintaining the alternate paths increases. Multi path routing protocols are:

(1) Multipath and Multi SPEED (MMSPEED)

(2) Sensor Protocols for Information via Negotiation(SPIN)

QUERY BASED ROUTING PROTOCOLS: The destination nodes propagate a query for data from a node through the network and a node having this data sends back the data to the node that matches the query to the query that initiates. The query normally uses high level languages. Query based routing protocols are:

(1) Direct Diffusion (DD)

(2) GOUGAR

NEGOTIATION BASED ROUTING PROTOCOLS: This class of protocols uses high level data descriptiors to eliminate redundant data transmission through negotiation . Based on the resources that are available to them, communication decision are taken. The motivation is that the use of flooding to disseminate data will produce implosion and overlap between the sent data. These protocols make intelligent decisions either for communication or other actions based on facts such that how much resources are available. Negotiation based routing protocols are:

(1) Sensor Protocols for Information via Negotiation(SPIN)

- (2) Direct Diffusion (DD)
- (3) Sequential Assignment Routing (SAR)

NETWORK FLOW AND QOS-BASED PROTOCOLS: There are some effective routing protocols proposed in different approaches which do not fit the above classification. In network flow, route is modeled and solve in a network. QoS-based protocols consider end-toend delay requirments and establish paths in sensor networks. In this case the application can delay sensitive so to achive this QoS metric network has to look for its energy consumption also. Which is another metric when communicating to the base station. So to achive Qos , the cost function for the desired Qos also needs to be considered. Example of such routing are:

(1) Sequential Assignment routing (SAR)

(2) SPEED

(3) Multipath and Multi SPEED (MMSPEED)

V. CONCLUSION

In the research paper we highlighted the different concepts of routing protocols with specific reference to energy efficient, fault tolerance, QoS in multipath routing protocols, and its implications of data transmission on wireless sensor network. Additionally the numerous types of routing techniques categorized on the basis of network infrastructure namely data-centric, hierachica, locationbased routing protocols and classification of sensor networks.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my guide Prof. O.S. Khanna for continuous support of my research works, for this motivation, enthusiasm and immense knowledge.

REFERENCES

- [1] Yick, J., B. Mukharjee and D. Ghosal, "Wireless Sensor Network Survey", Computer Network, pp.2292-2330, 2008.
- [2] Al-Karak, J.N and A.E Kamal, "Routing technique in wireless sensor network: A survey", Wireless communication, IEEE 2004, PP.6-28.
- [3] Akkaya, K. and M.Younis, "A survey on routing protocols for wireless sensor networkx", Ad hoc networks, pp.325-349, 2005.
- [4] Alwan, H. and A.Agrwal, "A survey on fault tolerant routing technique in wireless sensor network", In sensor technologies and Applications, IEEE, 2009.
- [5] Ahmedy, I., et al., "A review on wireless sensor networks routing protocol: Challenge in energy perspective", Scientific Research and Essays, pp.5628-5649,2011.
- [6] I. Akyildiz, W.Su,Y.Sankarsubramaniom, and E.Caeric, "Asurvey on sensor network", IEEE Communication Magzine, vol.40,Issue.8,pp.102-114, August 2002.
- [7] I. F. Akyildiz and W.Su and Y. Sankarasubramaniam and E.A. Cayirci, "Asurvey on sensor network, IEEE Communication Magzine, pp. 102-114, August 2004.
- [8] Prabhat Kumar, M.P Singh and U.S.Tariar,"Areview of routing protocols in wireless sensor network", International Journal of Engineering Research and Technology (IJERT), Vol.1, Issue.4,June 2012.
- [9] Dargie W. and Poellabaur C., "wireless Sensor Network Theory and Practice", John Wiley & sons, 1st edition, USA, 2010.
- [10] Sharma G, 2009, "Routing in wireless sensor networks", Master thesis, Computer Science and Engineering, Dept., Thapar Univ., Patiala.
- [11] Luis J. et al 2009, "Routing protocolsin wireless sensor networks", Sensor, Spain, www.mdpi.com/journal/sensor.
- [12] A. Manjeshwar and D.P. Agrwal, "TEEN: a routing protocol for enhanced efficiency in wireless sensor networks", In Ist International workshop on Oarallel and Distributed Computing Issue in Wireless Networks and Mobile Computing 2011.
- [13] Rajashree. V. Biradar, V.C. Patil, Dr. R.R. Mudholkar, D.S.R. Sawant, "Classification and Comparision of Routing Protocols in Wireless Sensor Networks", Ubiquitous Computing and Communication Journal Vol. 4, pp.704-711, 2009.
- [14] Cenete, Eduardo, Diaz, Manuel, Llopis, Luvs, Rubio,Bartolome, "HERO: A hierarchical efficient and

reliable routing protocol for wireless sensor networks", Computer communication, vol.35,pp.1392-1409.

- [15] Kyuhong Lee, Heesang Lee, "Energy Efficient Clustering and Routing Approach for Wireless Sensor Networks", Second Asian Himalayas international Conference(AH-ICI), PP.1-5, 2011.
- [16] D.P.S Edvinee Christin, Mrs R.Jothichitre, "Energy Efficient Secure Routing in Wireless Sensor Networks", Proceeding of ICETECT 2011,pp.982-986.
- [17] Wendi B.Heinzelman, Anantha P. Chandarakasan, Hari Balakrishnan, "An Application-Specific Protocol Architecture for Wireless Microsensor Networks", IEEE Transaction on Wireless Communication, Vol. 1, No. 4, pp. 660-670, October 2002.
- [18] Kazem Sohraby, Daniel Maniel, Taieb Znati, "Wireless Sensor Networks Technology Protocols and Applications", Second Edition Wiley India, 2010.

BIBLIOGRAPHY

Ozair Ahmad pursuing M.E (Electronics



Engineering) from NITTTR, Chandigarh. Presently he is working as Assistant Professor in Electronics & Communication Engineering, MAULANA AZAD COLLEGE OF ENGINEERING AND TECHNOLOGY, Neoraganj, Neora, Patna-Bihar, India

&

Communication