



## **A Review Paper on Routing Protocols in Wireless Sensor Networks**

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**Abstract-** This paper presents a literature review on WSN networks, in which the capacity of network nodes are limited with respect to energy supply, restricted computational capacity and communication bandwidth. To prolong the lifetime of these sensor nodes, designing efficient routing protocols are critical. Basically, the Routing protocols for wireless sensor networks are responsible for maintaining the routes in the network which ensures reliable multi-hop communication. In this paper, various protocols like Dynamic Source Routing (DSR), Dynamic MANET On-demand Protocol (DYMO), Zone Routing Protocol (ZRP) and Optimized Link-State Routing (OLSR) are discussed along with various comparative parameters like Residual Battery Capacity, Throughput, Average End-to-End Delay and Packet-Delay.

**Keywords-** Wireless sensor networks, Routing Protocols, DSR, ZRP and DYMO.

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### **I. INTRODUCTION**

A Wireless Sensor Network consists of many sensor nodes deployed in environment and connected to a base station that processes the sensed data from the sensors. All nodes of these networks behave as routers and take part in discovery and maintenance of routes to other nodes in the network. This situation becomes more complicated if more nodes are added within the network. An Ad-Hoc routing protocol must be able to decide the best path between the nodes, minimize the bandwidth overhead to enable proper routing, minimize the time required to converge after the topology changes.

Power consumption is an important issue in wireless sensor networks (WSNs). The wireless devices are functionally depending upon their battery life. Most of the attention has been given to the routing protocols since they might differ depending on the application and network architecture. So, to prolong the lifetime of the sensor nodes, designing efficient routing protocols are critical.

A single routing protocol cannot be efficient for sensor networks across all applications because they are application dependent [5]. In wireless network, routing protocols play an important role in managing the formation, configuration, and maintenance of the topology of the network. Here we discuss various routing protocols like Dynamic Source Routing (DSR), Dynamic MANET On-demand Protocol (DYMO), Zone Routing Protocol (ZRP), Optimized Link-State Routing (OLSR) and various parameters like Residual Battery capacity, Throughput, Average End-to-End Delay and Packet-Delay.

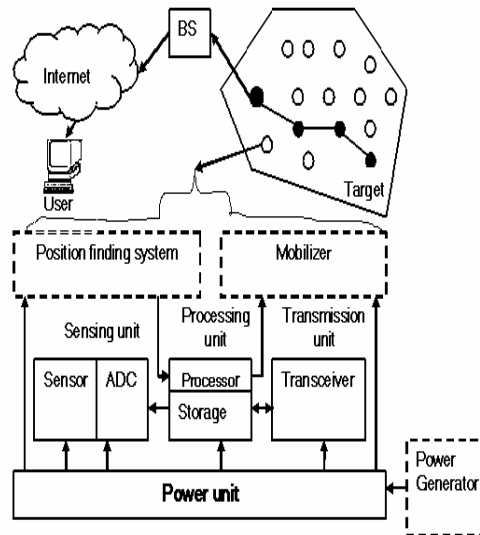


Figure 1: Structural view of sensor network

## II. PREVIOUS WORK DONE:

**Navneet Kaur et al.** “A Review on Reactive and Proactive Wireless Sensor Networks Protocols” In this paper, HEER (Hybrid Energy Efficient Reactive) Protocol has been proposed in which the Cluster Head (CH) selection is based on the ratio of residual energy of node and average energy of network. But HEER does not use the inter cluster data aggregation. To overcome this problem a deterministic approach will be proposed to enhance the cluster head selection. In this selection criteria will have deterministic decisions because node with highest first energy will become cluster head than the probability. It will increase the overall network lifetime.

**Rajashree.V.Biradar et al.** “Classification and Comparison of Routing Protocols in Wireless Sensor Networks” This paper analyze the design issues of sensor networks and present a classification and comparison of routing protocols. It is not possible to design a routing algorithm which will have good performance under all scenarios and for all applications. This comparison reveals the important features that need to be taken into consideration while designing and evaluating new routing protocols for sensor networks.

**Dharam Vir et al.** “Power Control and Performance Improvement of Reactive Routing Protocols using QualNet Simulator”. In this paper, we observed that increasing numbers of nodes also increases power consumption due to routing control packets as well as increasing number of nodes. Here the power consumption can be reduced by reducing the number of routing control packets to increase the life time of network. It contains various routing protocol like DYMO, DSR and AODV. It is found that the Packet deliver is better in case of AODV with increased traffic load and mobility. The simulation shows that DSR protocol exhibits good performance in comparison to other routing protocols.

**Pratibha et al.** “Performance Evaluation of OLSR and DSR Routing Protocols for Wireless Sensor Networks (WSN)”. This paper described a performance evaluation and comparison between two routing protocols (OLSR, DSR) for Wireless Sensor Networks. Both protocols were simulated using OPNET 14.5 and were compared in terms of end to end delay, throughput and network load with varying number of nodes (40, 60). It conclude that average throughput of OLSR is much better than

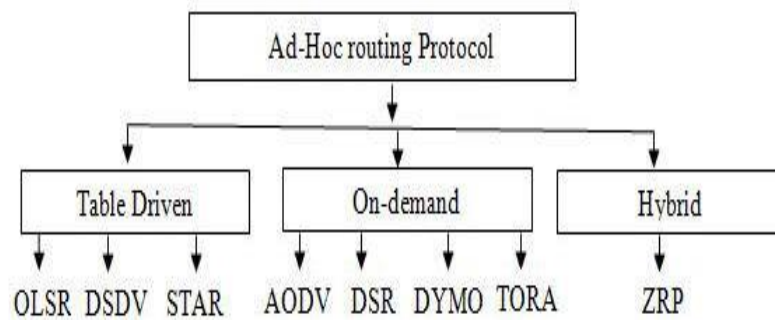
DSR and average end to end delay of DSR is much higher than OLSR and in terms of network load DSR shows less average network load as compared to OLSR routing protocol.

**Shio Kumar Singh et al.** “Routing Protocols in Wireless Sensor Networks –A Survey”. This paper analyze a survey of a sample of routing protocols by taking into account several classification criteria, including location information, network layering and in-network processing, data centricity, path redundancy, network dynamics, QoS requirements and network heterogeneity and compare their strengths and limitations.

### III. AD-HOC ROUTING PROTOCOLS

Routing is the process of finding a path from a source to destination among randomly distributed routers. Sensor Networks can be classified on the basis of their mode of functioning and the type of objective application into three major types. They are of three types:

- A. Proactive routing protocols
- B. Reactive routing protocols
- C. Hybrid routing protocols



*Figure 2: Classification of Ad-Hoc routing protocols*

- A. Proactive routing protocols: These routing protocols also called as table driven routing protocol. Continuously evaluate the routes within the network, so that when a packet needs to be forwarded the route is already known and can be immediately used. Table driven protocols maintain consistent and up to date routing information about each node in the network. These protocols require each node to store their routing information and whenever there is a change in network topology, the updates has to be made throughout the network. The table driven protocols for example are:
  - i. Destination sequenced Distance vector routing (DSDV)
  - ii. Source Tree Adaptive Routing (STAR)
  - iii. Optimized Link-State Routing(OLSR)[5]
- B. Reactive routing protocols: Reactive routing protocols, also called on demand routing protocol, it invokes a route only on demand. A node wishing to communicate with another node first seeks for a route in its routing table. If it finds one the communication starts immediately, otherwise the node initiates a route discovery phase. Once a Route has been established, it is maintained until either the destination becomes in accessible or until the route is no longer used or expired. For example

- i. Ad-Hoc On-demand Distance Vector (AODV)
  - ii. Dynamic Source Routing (DSR)
  - iii. Dynamic On-Demand MANET Routing Protocol(DYMO)[5]
- C. Hybrid routing protocol: This type of protocols combines the advantages of proactive and reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. These protocols maintain topology information up to m hops in tables. Here the network is divided into small clusters or zones. For Example:-
- i. Zone routing protocol (ZRP)
  - ii. Fisheye routing protocol [5].

### 3.1 Dynamic Source Routing (DSR) Protocol:

DSR protocol is a reactive protocol. In this all packets transmitted by the source node to a destination node and both follow the same path. In this routing route is determined only on demand.

DSR Procedure:

- i. During route process DSR floods a Route Request packets and the sequence number in the network.
- ii. This sequence numbers are used to prevent loop formation and this is checked by nodes.
- iii. Intermediate nodes forward this Route Request to the destination if it is not redundant and destination node replies with Route Reply Packet.
- iv. The Route Reply Packet contains the path traversed by Route Request packet.
- v. If node has a route in the cache, this route is used.
- vi. If the link is broken the Route Error is sent to the sender by node adjacent to a broken link [4]

### 3.2 Zone Routing Protocol (ZRP):

This protocol uses a combination of proactive and reactive routing protocols. In this, a network is divided into zones.

ZRP has three sub-protocols:

- i. Intra zone Routing Protocol (IARP)
- ii. Inter zone Routing Protocol (IERP)
- iii. Border cast Resolution Protocol (BRP)

Intra zone Routing Protocol is used when route lies within the zone and Inter zone Routing Protocol (IERP) is used outside the zone [11].

### 3.3 Dynamic on-Demand MANET Routing Protocol (DYMO):

It is a reactive routing protocol in which routes are computed on demand. The basic operations of DYMO are route discovery and maintenance. Route discovery is performed at source node to a destination for which it does not have a valid path. And route maintenance is performed to avoid the existing obliterated routes from the routing table and also to reduce the packet dropping in case of any route break or node failure [4].

### 3.4 Optimized Link State Routing (OLSR):

Optimized link state routing protocol (OLSR) is developed for mobile ad hoc networks. It is a proactive protocol. In this some nodes are selected as “multipoint relays” (MPR). This MPR nodes declare link-state information may be utilized, e.g., for redundancy [9].

#### IV. PERFORMANCE MATRICES

**Throughput:** Throughput is the average rate of successful message delivery over a communication channel. The throughput is usually measured in bits per second (bit/sec), and sometimes in data packets per second or data packets per time slot. High throughput is always desirable in a communication system.

**Jitter:** Jitter is the variation in delay by different data packets that reached the destination and can seriously affect the quality of audio/video and thus an unwanted parameter. Jitter should be small for a routing protocol to perform better.

**End-to-end Delay:** End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination. A data packet may take longer time to reach to the destination due to queuing and different routing paths.

**Packet Delivery Ratio:** It is defined as the ratio of total packet received by the destination to the total packet send by the source. If packet delivery ratio is high then it shows that it can receive maximum packet [5].

#### V. CONCLUSION AND FUTURE SCOPE

In this paper various papers regarding routing protocols have been discussed. Also number of routing protocol like DSR (Dynamic source routing), ZRP (Zone routing protocol) ,Dynamic MANET On-demand Protocol (DYMO),Optimized Link-State Routing (OLSR) were presented along with various performance parameters like Average End-to- End delay, Throughput, Residual Battery Capacity, and Packet-Delay. It can be concluded that by using different routing protocol the performance of WSN network can be enhanced. In future, by using different routing algorithms the performance of WSN networks can be more enhanced.

#### REFERENCES

1. Vivek Parashar, et al. “Behavior of Cluster Based Wireless Sensor Network at Different Packet Sizes” International Journal of Engineering Research & Technology (IJERT), Vol. 2, Issue 10, October 2013, ISSN: 2278-0181
2. Stefanos A. Nikolidakis et al. “Energy Efficient Routing in Wireless Sensor Networks through Balanced Clustering” [www.mdpi.com/journal/algorithms](http://www.mdpi.com/journal/algorithms) *Algorithms* 2013, 6, 29-42
3. M. Aslam, M. B. Rasheed et al. “Energy optimization and Performance Analysis of Cluster Based Routing Protocols Extended from LEACH for WSNs” COMSATS Institute of Information Technology, Islamabad, Pakistan.
4. Manju, Ranjana Thalore et al. “Performance Evaluation of Bellman-Ford, AODV, DSR and DYMO Protocols using QualNet in 1000m×1000m Terrain Area” International Journal of Soft Computing and Engineering (IJSCE) , Volume-2, Issue-6, January 2013, ISSN: 2231-2307.
5. Dharam Vir et al. “Power Control and Performance Improvement of Reactive Routing Protocols using QualNet Simulator” International Journal of Application or Innovation in Engineering and Management(IJAIEM),Volume 2,Issue 4, April 2013,ISSN:2319-4847
6. A. Chaudhary, V. N.Tiwari et al.“Analysis of Routing Protocols Based on Energy Consumption in Mobile Ad Hoc Networks Using Qualnet Simulator”, International Journal of Applied Research and Studies (IJARS), ISSN, vol. 3, Issue 1, (2014) January, pp. 2278-9480.
7. Bernsen, J. Manivannan et al. “Routing Protocols for Wireless Sensor Networks(WSN) That Ensure Quality of Service ” In Proceedings of the fourth international conference on Wireless and Mobile Communications., Aug. 2008.

8. Navneet Kaur et al. "A Review on Reactive and Proactive Wireless Sensor Networks Protocols" International Journal of Computer Applications (0975 – 8887) Volume 95– No. 11, June 2014.
9. Pratibha et al. "Performance Evaluation of OLSR and DSR Routing Protocols for Wireless Sensor Networks (WSN)" International Journal of Computer Trends and Technology (IJCTT), volume 12, No.5, Jun 2014, ISSN: 2231-2803
10. Shio Kumar Singh et al. "Routing Protocols in Wireless Sensor Networks –A Survey" International Journal of Computer Science & Engineering Survey (IJCSES), Vol.1, No.2, November 2010.
11. Sandeep Kaur et al. "Analysis of Zone Routing Protocol in Manet", International Journal of Research in Engineering and Technology(IJRET), Volume 02, Issue 09 Sep-2013, eISSN: 2319-1163 pISSN: 2321-7308
12. Dharam vir et al. "WSN Performance Evaluation of Power Consumption Anaiysis of DSR,OLSR,LAR and Fisheye in Energy Model through QualNet", International Journal of Scientific and Research Publication, Volume 3, Issue 12,December 2013
13. Anuj K. Gupta et al. "Implementation of DYMO Routing Protocol" International Journal of Information Technology, Modeling and Computing (IJITMC), Vol.1, No.2, May 2013.
14. Rajashree.V.Biradar et al. "Classification and Comparison of Routing Protocols in Wireless Sensor Networks" UbiCC Journal, Volume.4