Advanced Research in Electrical and Electronic Engineering
p-ISSN: 2349-5804; e-ISSN: 2349-5812 Volume 4, Issue 5, October-December, 2017, pp. 308-311

http://www.krishisanskriti.org/Publication.html

Exploring the Performance of Various Routing Protocols in WSN: A study

Dr. Himani Goyal Sharma[1] and Rina Sharma[2]

[1]HOD Professor Dept of Electrical Engineering, Poornima Institute of Engineering and Technology, Sitapura, Jaipur, Rajasthan 302022
[2]Research Scholar at I. K. Gujral Punjab Technical University (PTU), Jalandhar, Kapurthala highway, Punjab 144603
E-mail: [1]goyalhimani@gmail.com, [2]sharma.rina.gpe@gmail.com

Abstract—*A wireless network making use of sensors for monitoring physical as well as environmental conditions. Basic objective is the Energy efficiency in the field of WSN. The main objective of this research paper is to explore the performance of various existing routing protocols like AODV, DSDV, DSR and ACO routing protocols in terms of Packet Delivery Rate and Average Delay. Simulation based results and data analysis shows that AODV-PSO is more efficient in terms of overall performance as compared to other existing routing protocols for Wireless Sensor Networks.*

Keywords*: Wireless Sensor Networks, AODV, DSDV, Routing Protocol, Performance Comparison, Packet Delivery Rate, Average Delay.*

1. INTRODUCTION

The applications of wireless sensor networks consist of a wide variety of situations. In today scenario, Wireless Sensor Networks has gained enormous amount of attention of researchers across the world. Wireless sensor networks comprising of thousands of sensor nodes capable of sensing environmental information, processing it in efficient manner and transmitting the information back to base locations for further analysis [1].

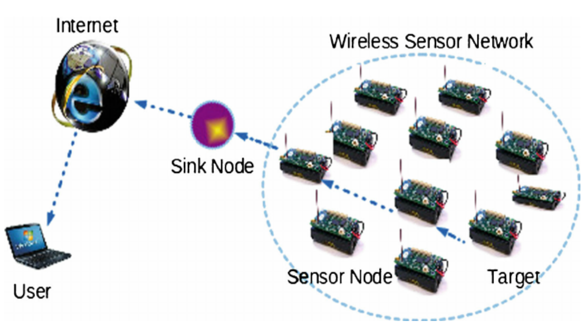

Figure 1: Wireless Sensor Network

A sensor node consists of sensing unit that senses any physical phenomenon, processing unit that performs different computations and communication subsystem that exchanges information between different nodes. [2]. Wireless Sensor Networks have limitation in terms of low memory, less processing speeds. A radio is integrated on nodes to transmit the information back to sink node. The nodes are powered using battery to act as main power source. As the batteries are the only and primary power source, it becomes difficult to replace and charge the batteries once nodes are deployed which remains the foremost challenge in front of researchers to enhance the Energy Efficiency of sensor nodes [1].

Different applications have different network requirements and these applications play an vital role in our day to day life. For example Health Monitoring System, in case of any emergency, immediate help can be provided. Applications of WSN for Disaster Management is discussed in that throw a light on how WSN architecture can be used in handling disaster management situations [2].

In order to increase node lifespan, energy harvesting has been used as an alternative to supplement batteries. Power managers typically adjust the wake-up period of the node (i.e. its duty cycle) to the environmental conditions. This method allows for optimizing the quality of service while ensuring the level of reliability required by industrial systems [3].

The main purpose of sensor networks is to gather regional/local information to participate in global decision about the physical environment. Different type of sensors like magnetic, visual, infrared, thermal, acoustic, seismic, and radar are available that encourage the use of these networks in wide range of applications like traffic control, environment monitoring, precision agriculture, weather forecasting, military surveillance, industrial sensing, etc. [4]

Each sensor node in the network consumes power, not only in sensing data, but also for processing the data and transmitting/receiving these processed information for further routing. The network lifetime has to be kept at its maximum by using the services of each sensor. In the case of WSN a routing protocol should be preferably simple – it should have less computational complexity, should be efficient in power consumption [5].

The two important factors that lead to an efficient sensor network design are

1) Energy Consumption

2) Quality of Service (QoS)

An energy utilization deal with the allocation of energy among all the nodes throughout the network and QoS depends upon high routing efficiency under multi hop transmission circumstances [7].

Emerging applications usually involve challenging computations and the need for real-time requirements such as guaranteed Quality of Service (QoS) and bounded end-to-end delay [8].

Moreover, according to the different types of application, the sensory data usually have different attributes. However, a sensor network that used for fire detection in a forest, any sensed data that carries an indication of a fire should be reported to the processing center within certain time limits [9].

Characteristics of Wireless Sensor Network [1]

- Limited memory
- Less power
- Unreliability
- Deployment of sensor nodes
- less computation capability

Reasons of Energy Waste

- When a receiver node receives more than one packet at the same time, which enhance the energy consumption.
- Overhearing, when a node receives packets that are intended to other nodes.
- Energy waste due to control packet overhead. Minimize the control packets in data transmission.
- Over emitting, when a destination node is not ready to receive packets.

Routing Protocols can be classified

Reactive Protocols: - Reactive protocols are also known as on demand routing protocols. They create a route only when the source node actually needs to send packets to the destination.

In proactive routing protocols, each node will be accessing set of tables, which contains routing information to every other node in the network. All the nodes update these tables to have a consistent and upto-date view of the network [6].

Approaches

Load Balancing (LB) technique decreases energy consumption, if LB is included in cluster based networks [2]

In Swam Intelligence, the most significant concept is “Swarm”. Swarm is used to refer any restrained collection of interacting individuals or agents. The idea of Swarm Intelligence was initiated by two most important Algorithms: Particle Swarm Optimization (PSO) being developed by Kennedy and Eberhart in 2001 and Ant Colony Optimization (ACO) being developed by Stutzle and Dorigo in 2004 [1].

EA-FSR uses the energy as the basis for selecting a neighboring node rather than the shortest path length. The energy of all the neighboring nodes is compared to find the node having maximum residual energy. Then this node is chosen to forward the packets. This process is performed for every node which has some packets to transmit. This mechanism ensures the energy balancing in the network as only one node is not constrained with the task of forwarding the data packets [4].

LEO: Simple Least-Time Energy-Efficient Routing Protocol with One-Level Data Aggregation. LEO is proactive, but the absolute route from each node to the BS is not necessary to be known by all the nodes in the network. Every node must have the information about its neighboring nodes only, in this way it reducing the memory requirement of each and every node [5].

2. LITRATURE REVIEW

Anand Nayyar and Singh [1] simulated and compared the performance of various existing routing protocols like AODV, DSDV and DSR routing protocols with ACO Based Routing Protocol in terms Packet Delivery Rate.

Sukhkirandeep Kaur and Roohie Naaz Mir [2] introduced a new clustering approach for WSN that includes load balancing and improves energy efficiency by precise selection of CH's. Analysis and simulation results demonstrate the effectiveness of the proposed approach. Andrea Castagnetti et.al [3], presented a global power management approach for energy harvesting sensor nodes. However, this approach is based on a joint duty-cycle optimization and transmission power control. Simulation results show improvement in energy efficiency and a packet reception ratio.

Harish Kumar et. al [4] have proposed a routing scheme based upon the fisheye state routing with a difference in route selection mechanism to make sure the decrease in the overall energy consumption of the network. This scheme is named as Energy-Aware Fisheye State Routing (EA-FSR). Comparison of various parameters like end-to-end delay average energy consumption and throughput have been conducted.

Sudip Misra and P. Dias Thomasinous [5] introduced a simple, least-time, energy-efficient routing protocol with one-level data aggregation that ensures increased life time for the network. Comparison of protocol with popular ad hoc and sensor network routing protocols AODV, DSDV, DD and MCF. According to the observation the proposed protocol outperformed them in throughput, average energy consumption, latency and average network lifetime

Jerrin Sebastian et. al [6] An algorithm is presented which can be used for overcoming the congestion, thereby increasing the total network utilization.

Piyush Charan et. al [7] examined the analytical models, which forecast the QoS in terms of throughput, average end-to-end delay, jitter, and energy consumption. Different network models are grid-based and cluster-based. Both are simulated using QualNet v 6.1 Simulator.

Goran Horvat et. al [8] presented a cross layered handover algorithm in order to improve declined performance and the QoS by means of multi-channel redundancy.

Jalel Ben et. al [9] discussed a multipath routing protocol (EQSR) and Quality of service, which optimized the network lifetime by balancing energy consumption among several nodes, with the attention of service segregation to give permission to delay important traffic to reach the sink node with in an acceptable delay, reduces the end to end delay through distributing the traffic across multiple paths. It is more energy efficient, having higher packet delivery ratio and lowering average delay.

3. PROPOSED WORK

This research paper is to evaluate the performance of various existing routing protocols like AODV, DSDV, DSR and ACO routing protocols with AODV- PSO Routing Protocol in terms of Packet Delivery Rate and Average Delay. Simulation based results and data analysis shows that AODV-PSO is more efficient in terms of overall performance as compared to other existing routing protocols for Wireless Sensor Networks.

4. RESULT AND DISCUSSION

Protocol	Packet Delivery Ratio
DSDV	86.8
AODV	84.4
DSR	89.6
ACO	92.9
AODV-PSO	99.9

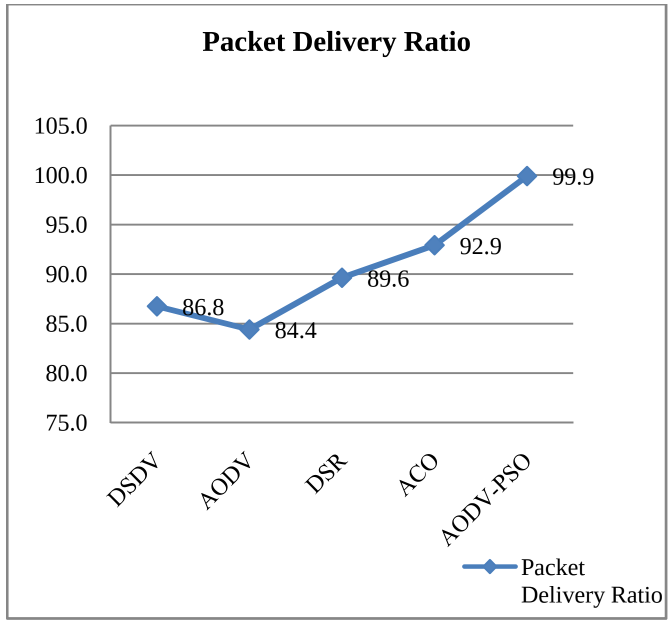

Figure 4.2: Packet Delivery Ratio according to various protocols

In the above Figure 4.2, this shows the Packet Delivery ratio according to various protocols. X-axis is used for protocols and Y-axis is used for PDR. It is also shown in the form of line graph.

Protocol	Average Delay
DSDV	7.28
AODV	5.95
DSR	7.21
ACO	2.13
AODV-PSO	0.0082

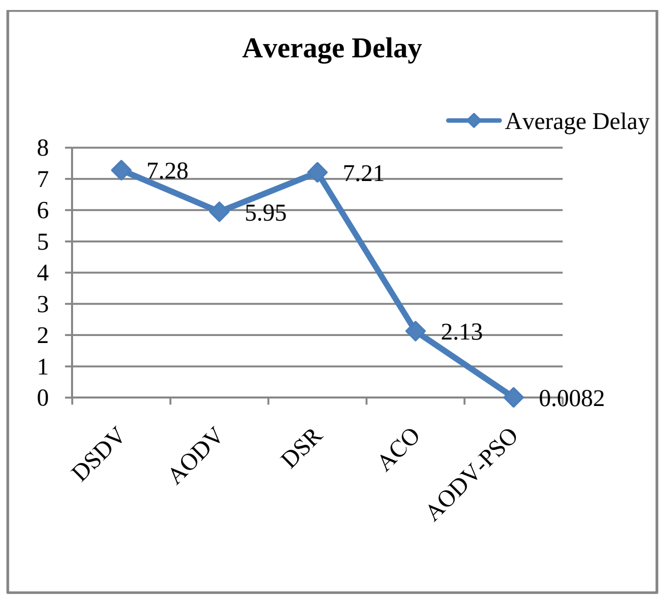

Figure 4.3: Average Delay taken according to various protocols

In Figure 4.3, this shows the Average Delay according to various protocols. X-axis is used for protocols and Y-axis is used for Average Delay rate. It is shown in the form of line graph.

5. CONCLUSION

Energy Consumption and Packet Delivery Ratio play a significant role in network performance. Various protocols like DSDV, AODV, DSR and ACO are compared with AODV-PSO. Performance evaluation is done on the following performance metrics like Packet Delivery Ratio and Average Delay. Simulation results show that Packet Delivery Ratio, Average Delay are improved

Analysis of the above data shows that Packet delivery ratio (PDR) is improved from 84.4 (AODV) to 99.9 (AODV-PSO). Reduction of average delay by 99.9%. It was 7.28 for DSDV and 0.0082 for AODV-PSO.

REFERENCE

[1] Anand Nayyar and Singh, "Simulation and Performance Comparison of Ant Colony Optimization (ACO), Routing Protocol with DSDV, AODV, DSR Routing Protocols of Wireless Sensor Networks using NS-2 Simulator", American Journal of Intelligent Systems 2017, 7(1): 19-30.

[2] Sukhkirandeep Kaur and Roohie Naaz Mir, "Energy Efficiency Optimization in Wireless Sensor Network Using Proposed Load Balancing Approach", International Journal of Computer Networks and Applications (IJCNA) Volume 3, Issue 5, September – October (2016).

[3] Andrea Castagnetti, Alain Pegatoquet, Trong Nhan LE, and Michel Auguin, "A joint duty-cycle and transmission power management for energy harvesting WSN", IEEE Transactions on Industrial Informatics 10 (2), 2014, 928-936.

[4] Harish Kumar, Harneet Arora and R.K. Singla, "Energy Aware Fisheye Routing algorithm for wireless mobile sensor networks", Cairo University, Egyptian Informatics Journal (2013) 14, 235–238.

[5] Sudip Misra and Dias Thomasinous, "A simple, least-time, and energy-efficient routing protocol with one-level data aggregation for wireless sensor networks", The Journal of Systems and Software 83 (2010) 852–860.

[6] Jerrin Sebastian, Smitha Jacob and Deepu Job "QoS Based Congestion Control Algorithm for Video Traffic in Wireless Mesh Network" International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 08 Aug-2016 Page 363-368.

[7] Piyush Charan, Rajeev Paulus, Tahsin Usmani, and Syed Hasan Saeed, "Performance Evaluation of AODV Protocol for Energy Consumption and QoS in IEEE 802.15.4 Based Wireless Sensor Network Using QualNet Simulator", Scientific Research Publishing, Wireless Sensor Network, 2016, 8, 166-175.

[8] Goran Horvat, Jelena Vlaovic and Drago Zagar, "Budva, Montenegro Improving QoS in Query-Driven WSN Using a Cross-Layered Handover Algorithm", 4th Mediterranean Conference on Embedded Computing MECO – 2015.

[9] Jalel Ben, Bashir Yahya and Othman, "Energy efficient and Quality of service based routing protocol for wireless sensor networks", J. Parallel Distrib. Comput. 70(2010)849–857.