Advanced Research in Electrical and Electronic Engineering
p-ISSN: 2349-5804; e-ISSN: 2349-5812 Volume 4, Issue 5, October-December, 2017, pp. 304-307

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

Energy Efficient Clustering Technique for WSN

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Abstract—*Information Technology is an indispensible part of our day to day life because of its wide range of applications. A wireless sensor network (WSN) is one of them making use of sensors for monitoring physical as well as environmental conditions. Challenges in the field of WSN is efficient energy consumption. Results of AODV & AODV-PSO are compared. Performance evaluation of AODV and AODV-PSO is done on the basic of following performance metrics like Total Energy Consumed, Load, Average delay, Average Throughput and Packet delivery ratio. Simulation results show that AODV-PSO is much better as compare to AODV.*

Keywords: *WSN, Efficient energy consumption, AODV, AODV-PSO, Total energy Consumed, Average throughput and Packet delivery ratio.*

1. INTRODUCTION

WSN Technology makes our life more easy, secure and automated. Wireless Sensor Networks (WSNs) is one such technology which plays a pivotal role in our day to day life. A wireless sensor network (WSN) is a network without wire which can sense the environment. WSNs was initially motivated by military applications like battlefield surveillance, but now it finds its applications in areas like healthcare applications, environmental monitoring, area monitoring, home automation, traffic control etc [1].

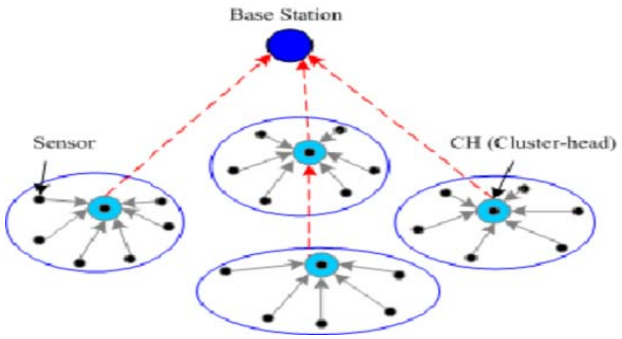

Figure 1.1: Wireless Sensor Networks

These networks are composed of hundreds or thousands of sensor nodes which have various types of sensors. However, through their sensors, nodes collect information about their environment such as light, humidity, motion and temperature etc. Sensor nodes should send their collected data to determined nodes called Sink. The sink node processes data and performs appropriate actions [2].

A wireless sensor has not only a sensing component, but also communication, on-board processing, and storage capabilities. With these enhancements, a sensor node is responsible for data collection, and also for information analysis, correlation, and arrangement of its own sensor data as well as data through other sensor nodes [3]. Advanced sensor network was initiated by DARPA by USA with the introduction of Distributed Sensor Networks (DSN) project in 1980 [4].

Research area in Wireless Sensor Network

Energy is consumed not only for the communication between sensor nodes but also through sensing the environment to collect data and processing of collected data. The major source of energy is the battery power. However, power unit supplies the battery power to sensor node, which can't be recharged. When the limited energy is used to cater the need of different functions of the sensor node than there is a need to properly consumed that energy because energy means life. If the energy is consumed properly only than the life of the network will be enhance.

Routing is a process of determining a route between the source node and the sink node on the request of data transmission [3]. A routing protocol for WSN must be ideally simple, having less computational complexity, efficient in power consumption, enhance the network lifetime and have less latency for data transmission from node to sink [6]. Energy efficient means energy consumed by the nodes must be minimum. Power aware means selecting a route with nodes having higher remaining battery power [7].

The next section of the paper related to literature review than proposed work in which the proposed algorithm is explained after that results are discussed and last section concludes the paper with future work.

2. RELATED WORK

Vandana Jindal et al. [1] analyzed various reasons to switch over between a wired network to a wireless network are distributing internet access, along with the files and printers, playing games, no more untidy wires required. Moreover, people using their mobile devices to access online news and other information on a daily basis are rising quickly. Amir Hussein Mohajerzadeh and Mohammad Hossien Yaghmaee [2] explained many different constraints, such as energy supply, computational power and storage capacity etc. The most important issue is the energy constraint. .

Hussein Mohammed Salman [3] explored the protocol of different categories like the level of privacy and security, functionalities, infrastructure, or the application which used for it. . Abdulaleem Ali Almazroi and Ma Ngadi [4] introduced an comprehensive review and categorization on the current routing sensor protocols. Moreover, the current multipath routing approach is extensively used in wireless sensor networks in order to get better network performance . Xiao Hui Li et al. [5] Presented a greedy-algorithm heuristic routing (GAHR) protocol for path searching. Compared the performance of this heuristic routing with the ad-hoc on-demand distance-vector protocol using a simulator.

Sudip Misra and P. Dias Thomasinous [6] provided a simple, energy-efficient, least-time routing protocol with one-level data aggregation that makes sure improved life time for the network. The protocol was evaluated with well known ad hoc and sensor network routing protocols. Ming Yu et al. [7] proposed a new energy-efficient dynamic clustering technique for large-scale sensor networks. A simple multiple hop routing algorithm that is designed to be both power-aware and energy-efficient, so as to lengthen the network lifetime.

Ahmed E.A.A. Abdulla et al. [8] presented a solution through a hybrid approach that combines two routing strategies, hierarchical multi hop routing and flat multi-hop routing. The former attempts to reduce the amount of traffic by adopting data density, and the latter aims to diminish the total power consumption in the network. Pratyay Kuila and Prasanta K. Jana [9] classified Linear/ Nonlinear Programming (LP/NLP) formulations of these problems pursued by two proposed algorithms based on particle swarm optimization (PSO). The results are analyzed to show their superiority in terms of energy consumption and network lifetime. Shashidhar Rao Gandham et al. [10] presented the deployment of multiple mobile base stations to extend the lifetime of the sensor network. Moreover, lifetime of the sensor network divides into equal slots of time known as rounds. Base stations are repositioned at the beginning of a round. Proposed technique utilizes an integer linear program to decide new positions for the base stations and a flows-based routing protocol to make sure power efficient routing throughout each round.

3. PROPOSED WORK

This research work mainly focused on the efficient use of energy to enhance the life of WSN. In the proposed system basic AODV protocol is compared with AODV-PSO. In the proposed system PSO based clustering algorithm is implemented, which improved the basic AODV protocol. Performance evaluation of AODV & AODV-PSO is evaluated on the basic of following performance metrics i.e. Total Energy Consumed, Load, Average delay, Average Throughput and Packet delivery ratio.

4. RESULT AND DISCUSSION

Parameter	AODV	AODV-PSO	Decrement
Total Energy Consumed	3353.75	3350.7	3.04

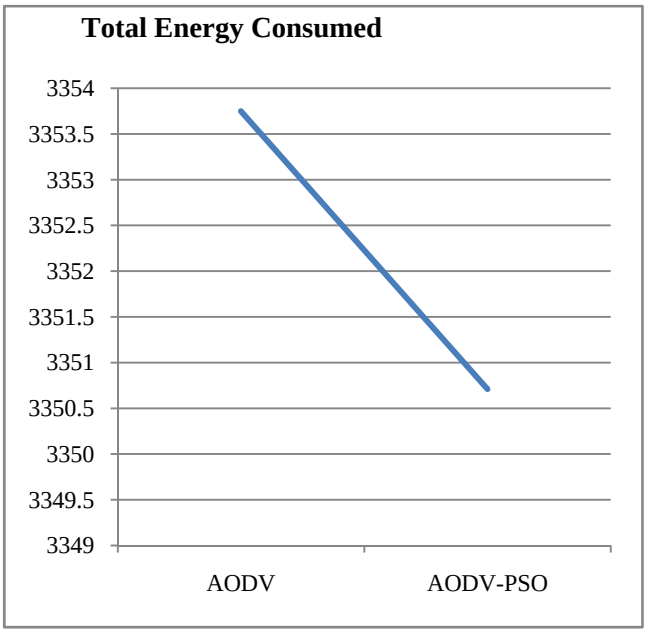

Figure 4.1: Total Energy Consumed in AODV & AODV-PSO

In the figure 4.1 which shows the Total Energy Consumed in AODV and AODV-PSO at 20 seconds. In the graph X-axis is used for AODV and AODV-PSO and Y-axis is used for Total Energy Consumed.

Parameter	AODV	AODV-PSO	Decrement
Load	0.371	0.2397	0.1313

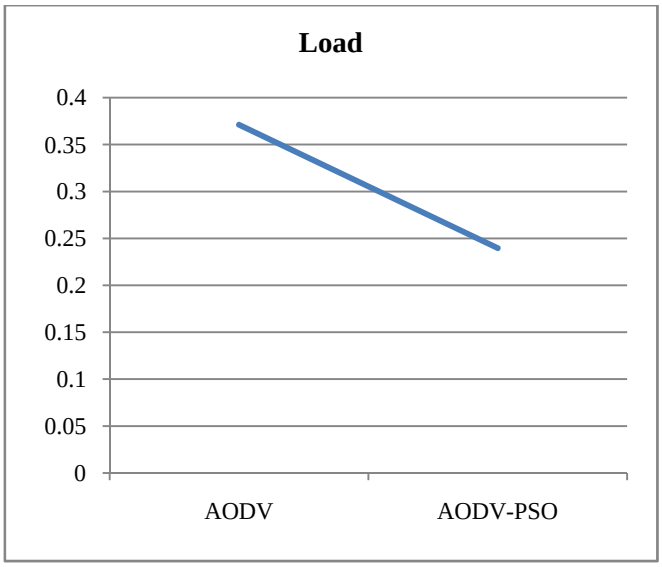

Figure 4.2 Total Loads in AODV & AODV-PSO

Figure 4.2 shows the Total Load in AODV and AODV-PSO at 20 seconds. X-axis is used for AODV and AODV-PSO and Y-axis is used for Total Load.

Parameter	AODV	AODV-PSO	Decrement
Average Delay	0.5871	0.0082	0.5789

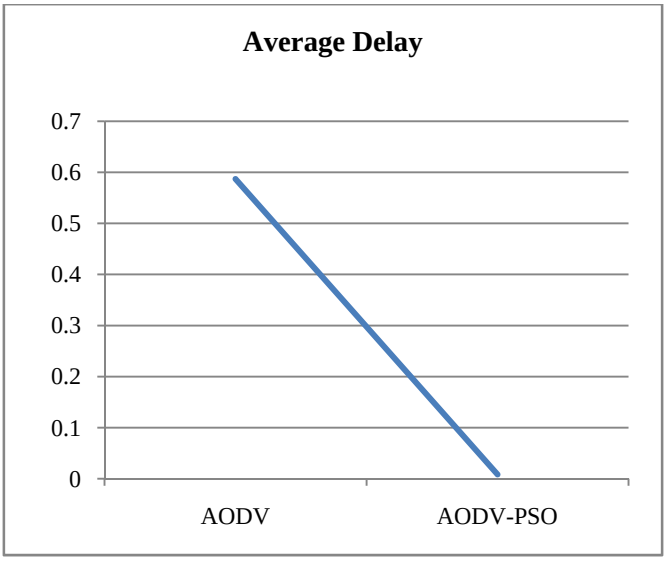

Figure 4.3 Average Delays in AODV & AODV-PSO

Figure 4.3 demonstrate the Average Delay in AODV and AODV-PSO at 20 seconds. X-axis is used for AODV and AODV-PSO and Y-axis is used for Average Delay during the packet delivery.

Parameter	AODV	AODV-PSO	Increment
Average Throughput	304483	359940	55457

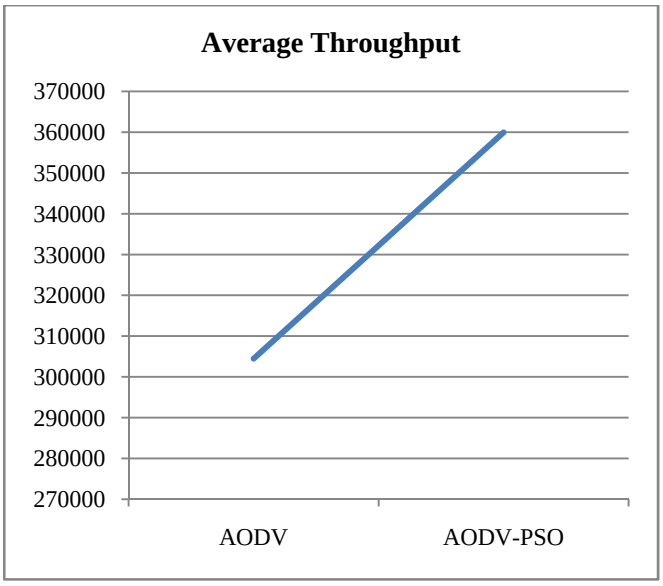

Figure 4.4 Average Throughputs in AODV & AODV-PSO

In the above figure 4.4 which shows the Average Throughput in AODV and AODV-PSO at 20 seconds. In the graph X-axis is used for AODV and AODV-PSO and Y-axis is used for Average Throughput.

Parameter	AODV	AODV-PSO	Increment
Packet Delivery Ratio	89.7482	99.914	10.16618

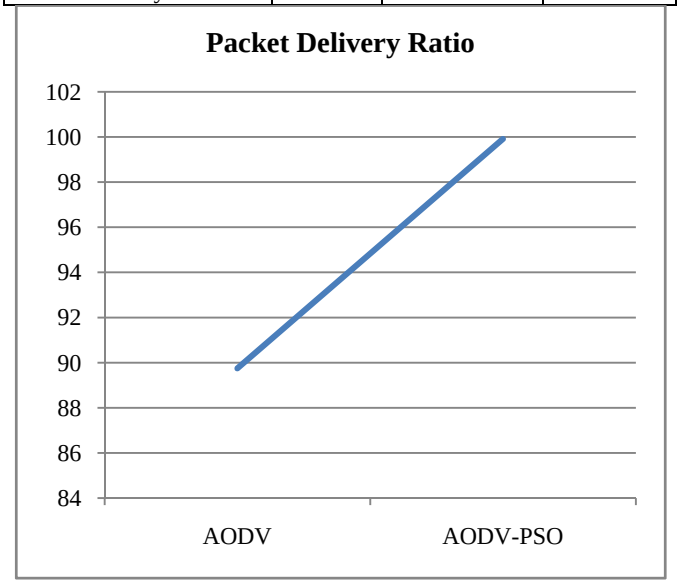

Figure 4.5 Packet Delivery Ratios in AODV & AODC-PSO

Figure 4.5 indicates the Packet delivery Ratio in AODV and AODV-PSO at 20 seconds. In the graph X-axis is used for AODV and AODV-PSO and Y-axis is used for Packet Delivery Ratio.

5. CONCLUSION

In this paper performance evaluation of AODV and AODV-PSO is done on the basic of following performance metrics like Total Energy Consumed, Average delay, Load, Packet delivery ratio and Average Throughput. Analysis of the above data shows that overall energy consumption is decremented by 0.09%. Load is also decreased by 35.39% from 0.371 (AODV) to 0.2397 (AODV-PSO). Average delay is reduced by 98.60%. Average throughput and packet delivery ratio incremented.

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