An Optimized Approach to Manage Energy Depletion in Routing Protocol for WSN

Priyapartap[1], Mohinder Singh[2]
[1]M.Tech Student, partap.priya1994@gmail.com
[2]Associate Professor, mohinder_90@rediffmail.com
Department of Computer Science & Engineering,
Maharishi Ved Vyas College of Engineering, Jagadhri, Yamunanagar

ABSTRACT

Routing is a process of determining a route between the source node and the sink node on the request of data communication. Route means path and route optimization means to choose the best path for efficient energy consumption and long life of network. Reducing energy consumption is the major concern for the enhancement of the network lifetime. These are the key requirements in the design of WSN protocols. Communications are the main element in energy consumption whether between node to node or node to sink. Several paths exist between each node and sink. Many different paths exist between each node and sink. Using optimized routing protocol, nodes determine a best possible path for sending data to sink. Routing protocols in wireless sensor networks regard as different parameters in their routing process according to their application. 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, Average delay, Average Throughput and Packet delivery ratio.

Keywords: Wireless Sensor Network, Adhoc on Demand Distance Vector Routing, Particle Swarm Optimization,

1. INTRODUCTION

In WSN there is a huge number of tiny size, low-valued and having restricted battery power sensors and few base stations. Sensors gather information from the environment and offer it to the sink. A sink is a controlling body that may part as an entry point to different networks. The WSN may be over and over sending on a tremendous scale in a geographic region in threatening conditions. The vast majority of the sensors connect specifically to coordinate and numbers of sensors pass the detected information to a nearby base station. This is impressive in light of the fact that loads of network applications include hundreds or might be a large number of sensor nodes, for the most part conveyed in detached and unapproachable zones [1]. A wireless sensor has parts for components for sensing, communicating, storing and processing. It is liable for data gathering, data analysis, finding relationship, and understanding of its individual sensor data as well as data gathered by other sensor nodes. At the point when expansive number of sensors all in all screens substantial physical environment, than they shapes a network which is called as wireless sensor network (WSN). Communication between different sensor nodes and also amongst sensor and a base station (BS) is conceivable through their wireless radios, which allow them to assign their sensed data for wireless processing, analyzing, visualizing, and storing [2].

Energy is an important source for the battery-based WSNs. To enhance the network lifetime to the extent that would be possible, energy effectiveness is one of the essential standards in the WSN protocol planning. To use the restricted energy existing at sensor nodes all the more proficiently, most accessible routing plans attempt to locate the lowest energy routing way to the sink for upgrading energy use at nodes [3].

2. HOW TO MAKE WSN MORE ENERGY EFFICIENT

The sensor node uses its implicit battery for sensing and communicating, when battery depleted, the node's becomes useless. Changement of batteries in substantial quantities of sensor node in wide region of hazardous domain as in war zone applications, inaccessible territories as in submerged checking applications is basically not doable. In any case, much research exertion has concentrated on amplifying the lifetime of the WSNs by means of a superior routing algorithm. Consequently, we are occupied with the disengagement of the sink node caused by the diminishment of the energy of sensor nodes encompassing it, this issue is named as the hotspot issue [8]. It is of most significance in light of the fact that in the occasion when the sink node is disengaged from whatever is left of the network, the WSN ends up futile. Regardless of whether the sensor nodes and the sink node are mobile or not. For the situation where the sink node is portable, the sink node moves around the sensing zone and gets information from the sensor nodes, subsequently proficiently adjusting the energy use in the WSN [5]. The sensor nodes can pass on the information occasionally or store the information and defer the transmission till the separation between the senor nodes and the mobile sink node is negligible so that to diminish the power utilized while transmitting information to the sink. For the situation where sensor nodes are mobile, the nodes can change their situation to assist adjust energy utilization in locales that have high transmission load. Nonetheless, conveying portable sinks and sensor nodes will build the WSN's arrangement costs [6].

In this unique situation, numerous analysts have proposed the utilization of some exceptional nodes called gateways, which are provisioned with additional energy. These gateways demonstrate like cluster heads and in charge of a similar functions of the CHs. [9]

As the battery lifetime is exceptionally restricted in WSN that why saving energy is the big issue in this field. Various energy saving approaches are used to control the energy uses. Improving power supply by energy gathering techniques that change encompassing energy for example sun and wind into electrical Energy [4].

Energy is an important source for the battery-based WSNs. To enhance the network lifetime to the extent that would be possible, energy effectiveness is one of the essential standards in the WSN protocol planning. To use the restricted energy existing at sensor nodes all the more proficiently, most accessible routing plans attempt to locate the lowest energy routing way to the sink for upgrading energy use at nodes [7].

3. PROPOSED WORK

PSO based clustering algorithm is implemented, which improved the basic AODV protocol. However, the evaluation is executed on the basic of following performance metrics i.e. Total Energy Consumed, Average delay, Average Throughput and Packet delivery ratio. We compared the performance of various existing routing protocols like AODV, DSDV, DSR and ACO routing protocols with AODV-PSO Routing Protocol.

4. RESULTS AND DISCUSSION

Section 1: Total Energy Consumption

Table 1: AODV VS. AODV-PSO Energy Consumption

Parameter	**Simulation Time (s)**	AODV	**AODV-PSO**
Total Consumed Energy	5	3350.63	3350.17
	10	3351.8	3350.35
	15	3353.02	3350.52
	20	3353.75	3350.71

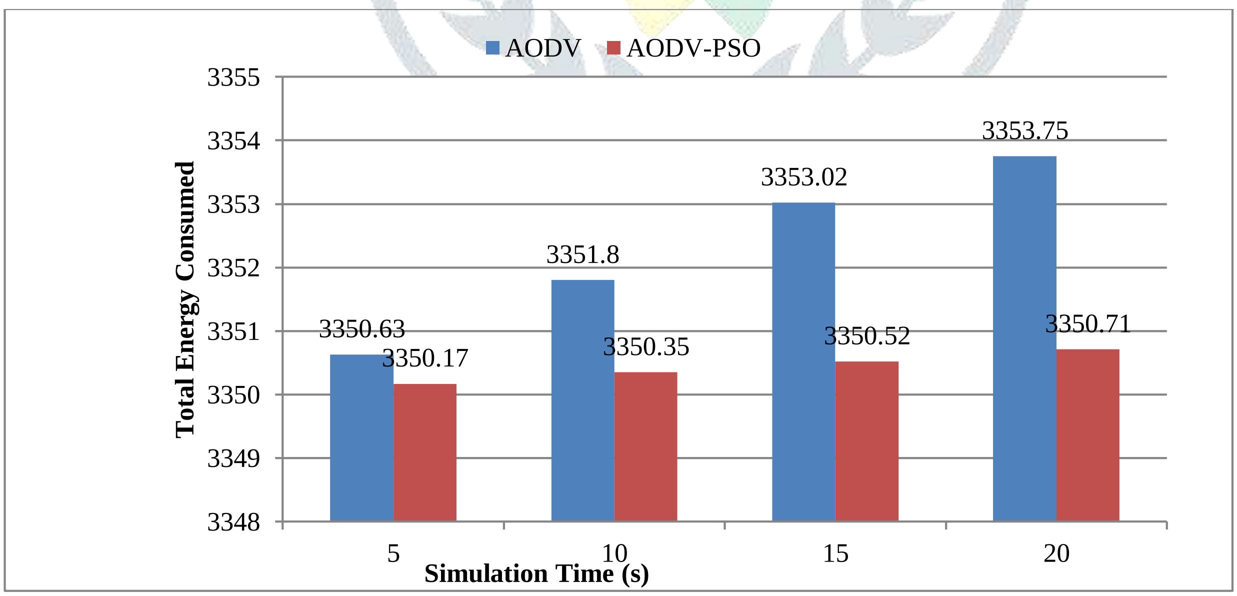

Figure 4.1 Total Energy Consumed in AODV & AODV-PSO

In the figure 5.1 which shows the Total Energy Consumed in AODV and AODV-PSO at various time durations from 5 seconds to 20 seconds. In the graph X-axis is used for simulation time in seconds and Y-axis is used for Total Energy Consumed. Blue column is used for AODV and Red column is used for AODV-PSO which is also shown by the Legend, which is placed at the top.

Section 2:

This research Section compare the performance of various existing routing protocols like AODV, DSDV, DSR and ACO routing protocols with AODV- PSO Routing Protocol in terms of Energy Consumption, Packet Delivery Rate, Average Delay and Average Throughput. 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.

Table 4.1: Energy Consumption of Various Protocols

Protocol	Energy Consumption
LEO	2.43
MCE	2.53
EA-FSR	3.13
FSR	3.55
PSCH 25%	2.24
PSCH 33%	2.54
AODV-PSO	1.61

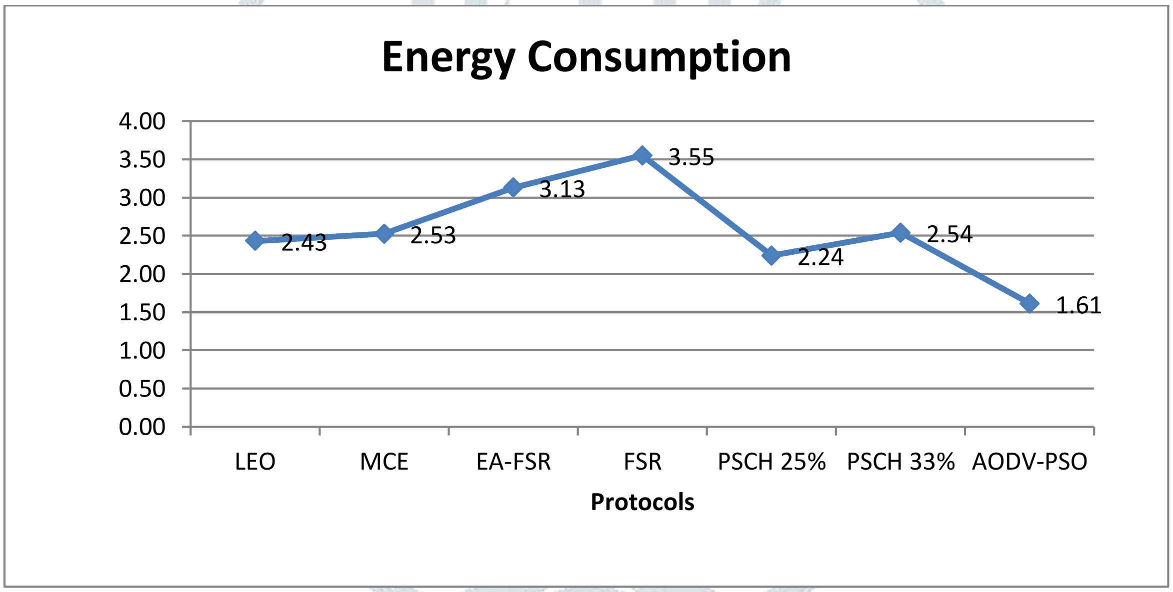

Figure 4.2 Total Energy Consumed according to various protocols

Figure 4.2 shows the Energy Consumption according to various protocols. X-axis is used for protocols and Y-axis is used for Energy Consumption. It is shown in the form of line graph.

Table 4.2: PDR of Various Protocols

Protocol	Packet Delivery Ratio
CLPM-FIXED	95.0
CLPM-PTPC	89.0
PSCH 25%	78.0
PSCH 33%	85.5
DSDV	86.8
AODV	84.4
DSR	89.6

ACO	92.9
AODV-PSO	99.9

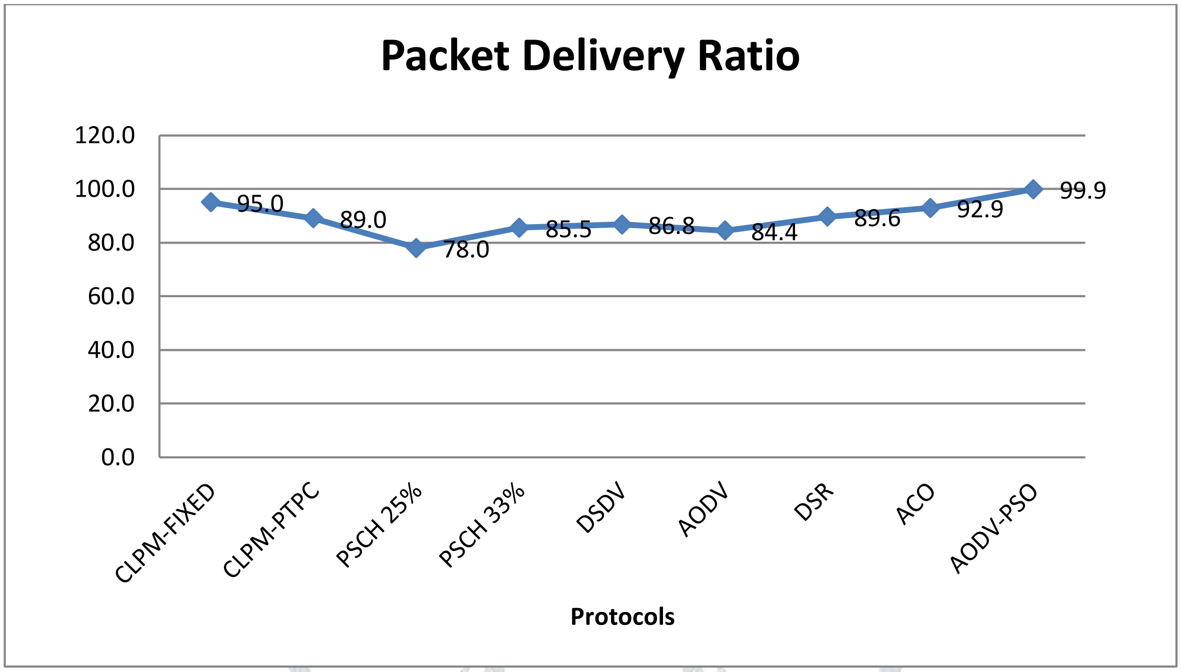

Figure 4.3 Packet Delivery Ratio according to various protocols

In the above Figure 4.3, 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.

Table 4.3: Average Delay of Various Protocols

Protocol	Average Delay
PSCH 25%	1.12
PSCH 33%	0.94
DSDV	7.28
AODV	5.95
DSR	7.21
ACO	2.13
AODV-PSO	0.0082

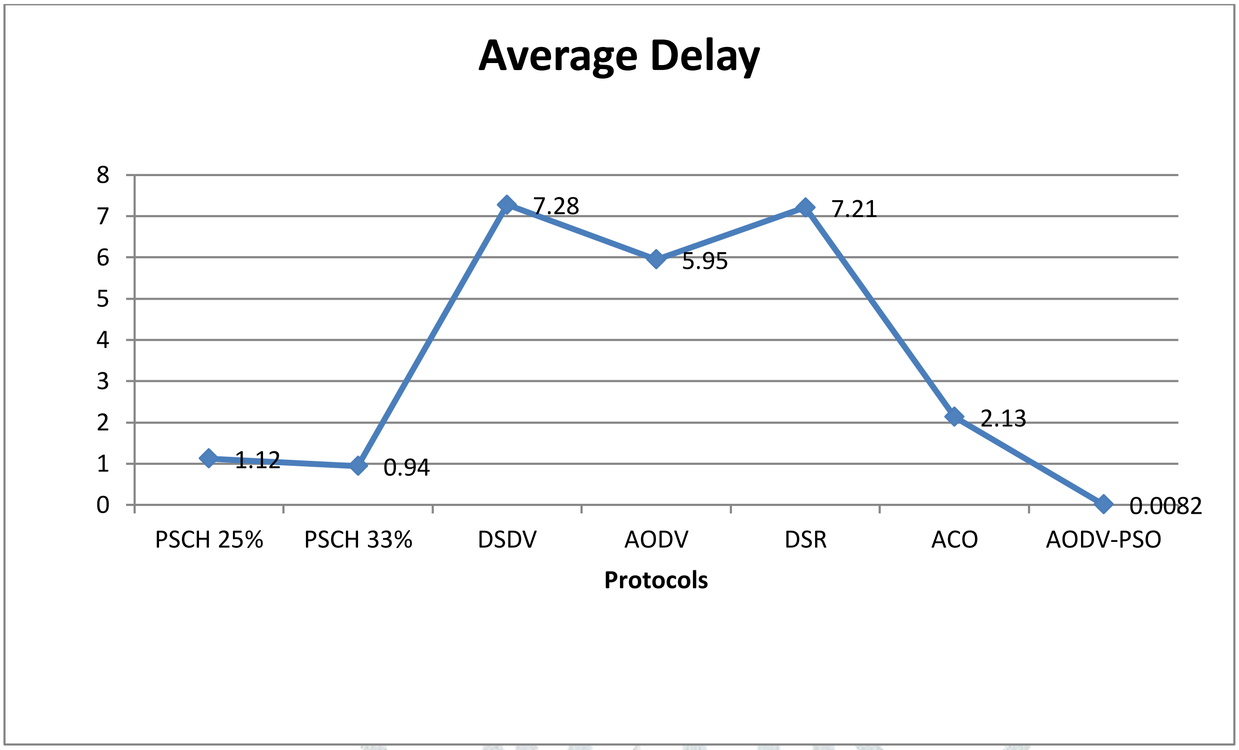

Figure 4.4 Average Delay taken according to various protocols

In Figure 4.4, 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.

Table 4.5: Average Throughput of Various Protocols

Protocol	**Average Throughput**
DSDV	6.24
AODV	8.21
DSR	8.02
ACO	9.58
AODV-PSO	3

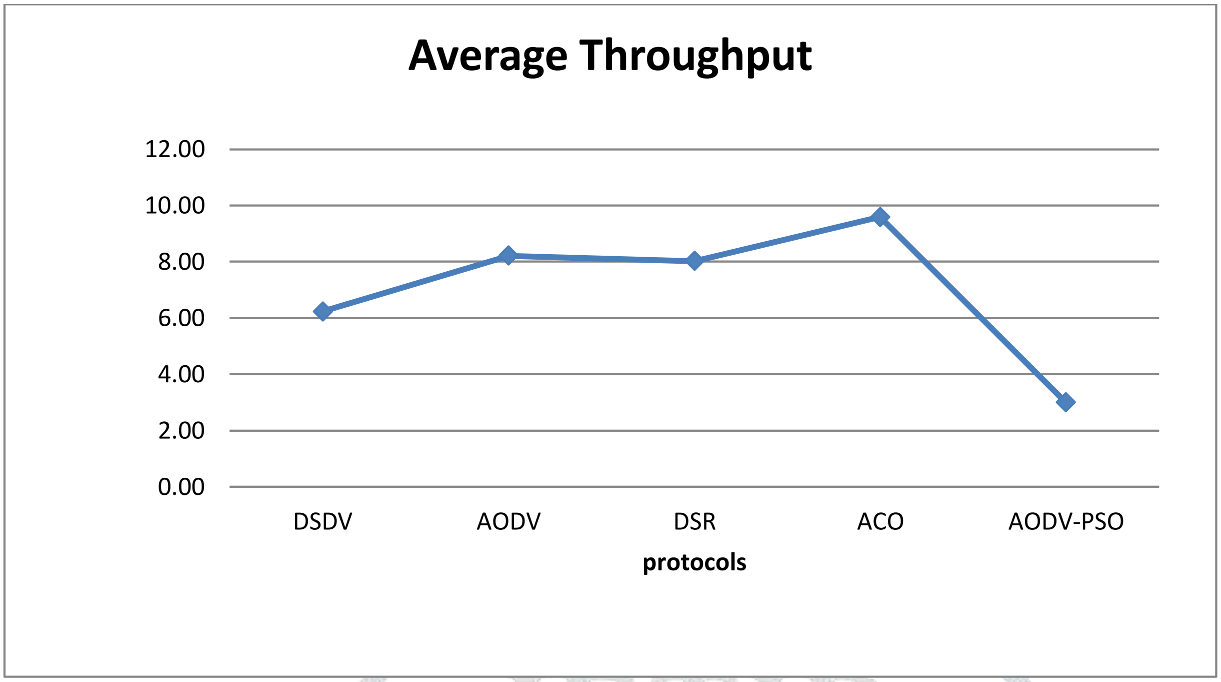

Figure 4.5 Average Throughput according to various protocols

Figure 4.5, shows the Average Throughput according to different protocols. X-axis is used for protocols and Y-axis is used for Average Throughput. It is also shown in the form of line graph.

CONCLUSION

In section 1, PSO based clustering algorithm is implemented, which enhanced the basic AODV protocol. 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. Analysis of the above data shows that overall energy consumption is reduced by 0.09%. It is 3353.75 for AODV and 3350.71 for AODV-PSO. Load is also decreased by 35.39% from 0.371 (AODV) to 0.2397 (AODV-PSO). Another factor which is affected by it is the reduction of average delay by 98.60%. It was 0.5871 and reduced to 0.0082. Remaining two factors enhanced which are average throughput and packet delivery ratio. Average throughput was 304483 and enhanced by 55457 and became 359940. There is an overall increase of 18.21%. Packet delivery ratio (PDR) is improved by 10.17 from 89.75(AODV) to 99.91 (AODV-PSO). However, there is an enhancement in PDR by 11.33%.
Section 2, Quality of service parameters like Energy Consumption, Packet Delivery Ratio, Average Delay and Average Throughput plays significant role in network performance. Various protocols like DSDV, AODV, DSR, ACO and CLMP are compared with AODV-PSO. Performance evaluation is done on the following performance metrics like Energy Consumption, Packet Delivery Ratio, Average Delay and Average Throughput. Simulation results show that Energy Consumption, Packet Delivery Ratio, Average Delay are improved
Analysis of the above data shows that overall energy consumption is reduced by 54.6%. It is 3.55 for FSR and 1.61 for AODV-PSO. Another factor which is affected by it is the reduction of average delay by 99.9%. It was 7.28 for DSDV and 0.0082 for AODV-PSO. Packet delivery ratio (PDR) is improved by 28.1% from 78 (PSCH25%) to 99.9 (AODV-PSO). However, Average throughput was also reduced from 9.58 to 3 but the other three factors improved their performance.
In the current scenario sensors are used by almost all the fields for the security and safety purpose. In WSN battery has the limited capacity so there is a need of energy conservation that can be achieved by energy aware routing or clustering. Both of the techniques are discussed and analyzed. Clustering effectively reduces the energy consumption and increase the lifetime of a sensor network but it is difficult to determine the total number of base stations and to select the next base station. More work is to be done on assignment of nodes in a cluster and suitability in the dynamic environment. Energy aware routing ensures to identify the best possible route to the destination. It performs better in terms of network life, outstanding level of energy efficiency, number of hops and the total data packets transmission. Scalability is required to improve the performance.

REFERENCES

1. Vandana Jindal, A.K.Verma and Seema Bawa, "How the two Adhoc networks can be Different: MANET& WSNs", International Journal of Computer Science and Technology,Vol.2(4), pp. 122-126,2011
2. Amir Hossein Mohajerzadeh and Mohammad Hossien Yaghmaee, "Tree Based Energy and Congestion Aware Routing Protocol for Wireless Sensor Networks", Journal of Wireless Sensor Network, pp. 161-167, 2010
3. Hussein Mohammed Salman, "Survey of Routing Protocols in Wireless Sensor Networks", International Journal of Sensors and Sensor Networks. Vol. 2, No. 1, 2014, pp. 1-6.
4. Abdulaleem Ali Almazroi and Ma Ngadi, "A Review on Wireless Sensor Networks Routing Protocol: Challenges in Multipath Techniques", Journal of Theoretical and Applied Information Technology 20th January 2014. Vol. 59, No.2

5. Md Azharuddin, Pratyay Kuila and Prasanta K. Jana, “Energy Efficient Fault Tolerant Clustering and Routing Algorithms for Wireless Sensor Networks”, Journal of Computers and Electrical engineering, Vol. 67, pp. 997-1002, 2014
6. Ahmed E.A.A. Abdulla, Hiroki Nishiyama and Nei Kato, “Extending the Lifetime of Wireless Sensor Networks: A Hybrid Routing Algorithm”, Journal of Computer Communication, Vol. no. 35, pp. 1056 to 1063, 2012
7. 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)
8. Licai Zhu, Ruchuan Wang, Hao Yang, "Multi-path Data Distribution Mechanism Based on RPL for Energy Consumption and Time Delay", Preprints (www.preprints.org), 2017, 8, 124; doi:10.3390/info8040124
9. A. Sebastian, S. Sivagurunathan, "A Survey on Load Balancing Schemes in RPL based Internet of Things", IJSRNSC, Volume-6, Issue-3, June 2018