

# Review on Mobile Sink Based Routing Algorithm for Wireless Sensor Networks

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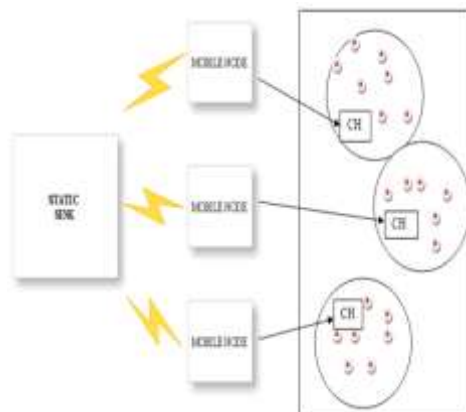
**Abstract:** A wide variety of applications in our daily life used is based on the sensors. The main downside with the sensors is that it is resource constrained mainly with respect to energy storage capacity. Because of its miniature size it can be easily deployed to the monitoring devices. The significant requirement is that the sensors should have a continuous connectivity to the deployed area. If it fails the entire process will be ineffectual. The communication process in the network consumes more energy. To enhance the lifetime of the network, the energy should be used effectively. Different protocol stacks and its layers keep their own strategies to reduce the consumption of energy level. The network layer plays an important role in routing. Thus a study is made to enhance the network life time.

**Keywords-** Clustering, Energy efficiency, Mobile sink, Node Isolation, Routing, and Wireless Sensor Networks.

## INTRODUCTION

Wireless sensor networks play a major role in today's world by making it to use in wide variety of appliances that we use in our day-to-day life. The tiny sensor nodes referred as motes deployed in huge number to sense the physical phenomena such as temperature, humidity, etc., A variety of development method uses wireless sensor networks in different applications like monitoring applications, rescue and surveillance applications, and medical industrial and engineering applications.

Due to its miniature size and low cost they are made to use in common. They are deployed in all kinds of areas such as normal landscape, undergrounds and kept more feasible.

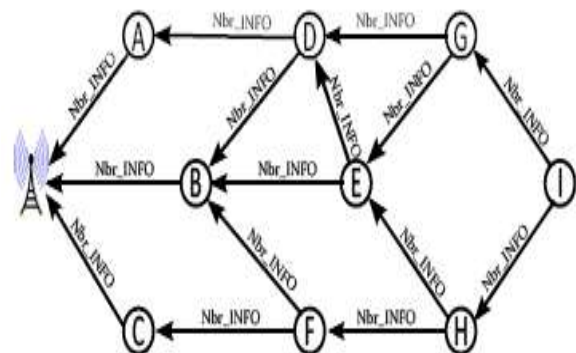


Sensors can be deployed in ad-hoc manner and are made to operate in a self-sufficient manner. In the surveillance environment, sensors cannot be easily recharged or replaced. The energy consumption is a serious issue in Wireless Sensor Networks that must be taken into consideration. A number of WSN methods are designed to make use of the energy efficiently.

Suraj Sharma et al of [1] have made known a Cluster Based Multipath Routing Protocol for Wireless Sensor Networks. It is based on the concept of giving responsibility to the sink on the process of reducing the energy consumption of the network. Wang et al in [2] has put forth an efficient routing protocol where nodes are deployed in random and mobile sinks are used. A stable election approach is used to choose the cluster head among the nodes based on the residual energy of the node. Jenq-shiou et al in paper [3] have defined a Regional Energy-Aware Clustering algorithm with Isolated Nodes. Here the Cluster Head are elected based on lasting energy and regional middling energy. The Node Isolation problem can be prohibited by the decision of forwarding the data of the isolated node to the Mobile sink or to the nearest Cluster Head.

## LITERATURE REVIEW

Cluster based Multipath Routing Protocol (CMRP) has been defined by Suraj Sharma in paper [1]. In this mechanism the path for the transmission of data area computed based on the priorities. It needs a path from the CH to the base station. The routes are computed by the base station based on the energy level of each node.



A neighbor discovery phase is defined once the sensor nodes are deployed. After the completion of above

phase, the topology construction phase is initiated. There each node uses the multicasting technique. The neighbor information from the initiator node is sent to the BS. Looping is avoided by forwarding the packet to one source. A neighboring list is maintained by each node to avoid traffic. Thus energy can be reduced during the routing process.

	BS	A	B	C	D	E	F	G	H	I
BS	0	1	1	1	0	0	0	0	0	0
A	1	0	1	0	1	0	0	0	0	0
B	1	1	0	1	1	1	1	0	0	0
C	1	0	1	0	0	0	1	0	0	0
D	0	1	1	0	0	1	0	1	0	0
E	0	0	1	0	1	0	1	1	1	0
F	0	0	1	1	0	1	0	0	1	0
G	0	0	0	0	1	1	0	0	0	1
H	0	0	0	0	0	1	1	0	0	0
I	0	0	0	0	0	0	0	1	1	0

The authors of paper [2] have defined a modified Stable Election Protocol (SEP) which uses a Mobile Sink and Non-Uniform node Distribution. The Cluster Head are selected based on the additional energy and the residual energy of each node. Once the node is elected to be as Cluster Head it finds the shortest path to the sink by direct mode or by an indirect approach. Here the network is considered to be as Heterogeneous.

FACTOR	EXPLANATION
$E_0$	Initial Energy of the node
$E_0(1+\alpha)$	Advanced Energy of the node
M	Percentage of advanced nodes
N	No of nodes
$\alpha$	Additional Energy factor

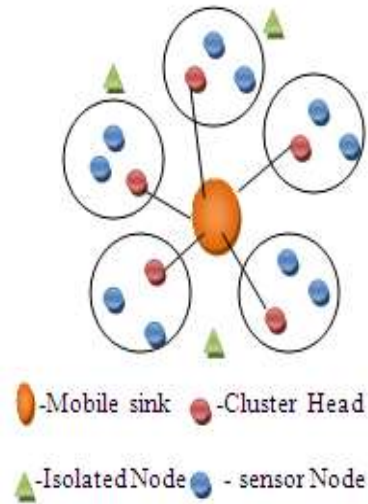
The overall energy of the network includes the above said factors. It can be calculated by the following formula:

$$N \cdot (1-m)E_0 + N \cdot m \cdot E_0(1+\alpha) = N \cdot E_0 \cdot (1+\alpha m)$$

During the data collection phase, by the MSE algorithm, the non CH nodes forward the data to the Cluster Head. While receiving a number of data from the non CH, all the data are fused together to a single data, and then the CH is left to be in sleep mode to further reduce the energy consumption. Once the Mobile sink moves near to the CH, it forwards the data to the sink.

Jenq-shiou et al have presented an REAC-IN protocol. The residual energy and the regional average energy are considered. In process of clustering, the node with high residual energy directs a JOIN\_REQ message to the non CH nodes. If the node receives many JOIN\_REQ messages, it chooses the CH with the shortest distance. There are chances for the nodes not

to receive any JOIN\_REQ messages. Such nodes do not form into a cluster. They are the isolated nodes.



During data transmission the isolated nodes are allowed to transmit their sensed data either to the nearby CH or to the mobile sink. It is based on the shortest distance to the isolated node. The residual energy is also taken into consideration for data transmission.

PARAMETER	DEFINITION
$\mu$	The Cluster Head node in the previous round
I	The current node
S	The sink node
$D_{i,\mu}$	The distance between i and $\mu$
$D_{\mu,s}$	The distance between $\mu$ and s
$D_{i,s}$	The distance between i and s
$E_i(r)$	The residual energy of i
$E_{c,i}(r-1)$	The regional average energy of the cluster c where I belongs to at the round r-1
$C_{direct,i}$	The energy cost for directly transmitting a k-bit message from i to s
$C_{relay,i}$	The energy cost for relaying a k-bit message from i through $\mu$ to s
$E_{elec}$	The energy cost of transmitter Electronics
$E_{amp}$	The energy cost of transmit amplifier

The initial process starts with the clustering. The clustering of nodes is done with the help of LEACH (Low Energy Adaptive Clustering Hierarchy) algorithm. The node is elected as CH based on each round by the following formula:

$$T(n_i) = \begin{cases} \frac{P_i}{1-p_i \times (r \bmod \frac{1}{p_i})} & \text{if } n_i \in G \\ 0 & \text{otherwise.} \end{cases}$$

The isolated node transmits the data directly to the sink or by relayed path. The transmission energy can be calculated as:

$$C_{direct,i} = k(E_{elec} + \epsilon_{amp} * D_{i,s}^2)$$

$$C_{relay,i} = k(2E_{elec} + \epsilon_{amp} * (D_{i,\mu}^2 + D_{\mu,s}^2))$$

Thus the above process is repeated for each round thus providing a way for prolonging the lifetime of the network.

**CONCLUSION**

Wireless Sensor Networks play an important role in numerous applications. A significant draw back with the sensors is its resource inhibited nature. Steps are taken at different stages of the network to reduce the energy consumption to a greater extent. Different algorithms are proposed in each paper to efficiently make use of the energy. Clustering and routing are the major processes in the Network Layer. A study is made on different clustering algorithms and its efficiency is compared based on Latency, Stability, Mobility, Packet Delivery Ratio and lifetime of the network. The following tabulation lists about the different techniques implemented. Thus a review is made on increasing the life time of the network.

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It is identified that among these protocols, the REAC-IN protocols shows better performance on increase in the lifetime of the network to 40%.

PROTOCOL USED	NUMBER OF NODES ALIVE IN 500(S)	AMOUNT OF DATA RECEIVED (IN BYTES)	LIFETIME OF THE NETWORK IN 500(S)
LEACH	350	300000	295
HEED	400	380000	340
SEP	380	395000	360
DEEC	400	450000	370
REAC	440	530000	395
REAC-IN	475	640000	430

**REFERENCES**

[1]. L. Qing, Q. Zhu, and M. Wang, "Design of a distributed energy-efficient clustering algorithm for heterogeneous wireless sensor networks," *Comput. Commun.* vol. 29, no. 12, pp. 2230–2237, Aug. 2006.

[2]. Jin Wang, Zhongqi Zhang, Feng Xia, Weiwei Yuan and Sungyoung Lee, "An Energy Efficient Stable Election-Based Routing Algorithm for Wireless Sensor Networks", *ISSN 1424-8220 journal*, sensors, 2013

[3]. Jenq-Shiou Leu, Tung-Hung Chiang, Min-Chieh Yu, and Kuan-Wu Su, "Energy Efficient Clustering Scheme for Prolonging the Lifetime of Wireless Sensor Network With Isolated Nodes", *IEEE communications letters*, vol. 19, no. 2, february 2015.

[4]. Baranidharan.B and S.M. Kalaiselvi, "A Survey on energy efficient protocols for Wireless Sensor Networks." , *International Journal of Computer Applications* 11,no.10,2010.

[5]. S. Mueller, R. P. Tsang, and D. Ghosal, "An efficient n-to-1 multipath routing protocol in wireless sensor networks." *In Proceedings of IEEE International Conference on Mobile Adhoc and Sensor Systems Conference*, pages 672–679, Nov 2005.

[6]. Tyagi, S, Kumar N, "A systematic review on clustering and routing techniques based upon LEACH protocol for wireless sensor networks." *J. Netw. Comput. Appl.* 2013, 36, 623–645.

[7]. Li, X, Nayak, A, Stojmenovic, I. "Sink mobility in wireless sensor networks". *Int. Fed. Inf. Proc.* 2010, 153–184.

[8]. Yu, J.G. Qi, Y.Y. Wang, G.H. Gu, X, "A cluster-based routing protocol for wireless sensor networks with Nonuniform node distribution." *Int. J. Electron. Commun.* 2012, 66, 54–61.

[9]. Jiang, J.A. Lin, T.S. Chuang, C.L. Chen, C.P. Sun, C.H. Juang, J.Y. Lin, J.C. Liang, W.W, "A QoS-guaranteed coverage precedence routing algorithm for wireless sensor networks." *Sensors* 2011, 11, 3418–3438.

[10]. Miao Yu, Jason H.Li and renato Levy, "MobilityResistant Clustering in Multi-Hop Wireless Networks", *Journal of Networks*, Vol.1, No.1, May2006.

[11]. O. Younis, S. Fahmy, "HEED: A Hybrid, Energy-Efficient, Distributed clustering approach for Ad Hoc sensor networks", *IEEE Transactions on MobileComputing*, 3 (4) (2004) 366–379.

[12]. Yi-hua zhu, Wan-deng wu, Jian pan, Yi-ping tang, "An energy efficient data gathering algorithm to prolong lifetime of wireless sensor networks", *Computer Communications*, 33(2010) 639-647.