



# VARIOUS PROTOCOLS FOR ENERGY EFFICIENCY USING CLUSTERED BASED IN WSN

Anjali Dhamiwal

Amity University, Haryana

Email:- Duggu.sharma17@gmail.com

## Abstract

WSN stands for wireless Sensor Network. It is infra less architecture of Network. It has numerous distributions of sensor nodes. There are several sensing devices that can be used to communicate with each other in a Network. In the Network, each sensing nodes has unique number for communication. In this we will discuss on the issues that occurred during transmission in WSN. As we know that energy efficiency is the common operation challenge. In this we can used clustering based approach to save the energy of nodes. In this we used routing protocols to save the energy before node die. There are some routing protocols such as Leach, leach FL, Pegasis, Teen .There are also few AI techniques that is used for clustering approach.

## Introduction

WSN is a wireless network. In this type of network , each node can be communicate with each other with the help of nodes. It change according to its connection. It is infra-less connection. There is no centralised authority. There are no security of data or information. Its structure is not static it is dynamic change structure of nodes . it is used in military areas, personal area , as Bluetooth. Its advantages are lower cost, self establishment , self configuration. There are some issue of this network such as ; nature of nodes, energy consumption, coverage region, scalability, quality of service. Its objectives are to identify the cluster based objective. (2) to find optimal solution for energy efficiency. Its applications are battlefield, air pressure, temperature, Nosie level, patient . agriculture and IOT.

## Background study

WSN stands for Wireless Sensor Network. it consists several sensor nodes that has unique number for transmission of data. As we know that there are sensor nodes that used for communicate with each other. It is infra- less architecture. There are several issues in this network like energy consumption, limited bandwidth, limited storage and stability of nodes. Energy efficiency is the main issue in network. sensor node has limited energy . nodes will die easily after finish its energy. If we used routing protocols, than we can easily increase the life. Energy will increased by routing protocols such as Leach, Pegasis, Leach-FL, Teen, Gear, GPRS etc. leach is the oldest and first protocol that help to increase the lifespan of the network. We can use AI techniques

such as genetic Algorithm, Fuzzy Logic and Neural Network. if we use Leach with fuzzy logic then it increase the energy of nodes. Apart from communication rules, other factors such as network architecture, management of topology can also affect energy consumption. In this section, we discuss the network architectures possible for wireless communication and briefly review the energy-efficient approaches used under the most promising network structure.

## Network structure

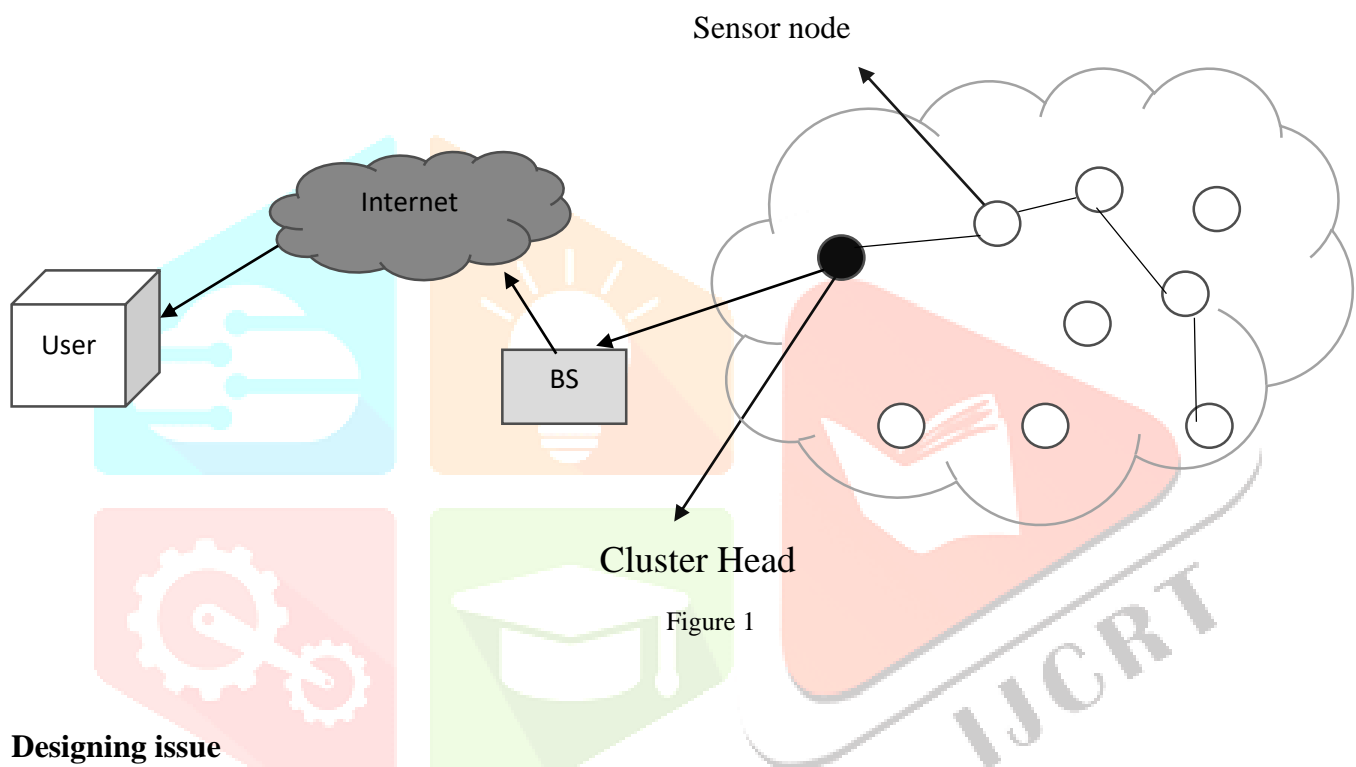


Figure 1

## Designing issue

There are some issues while designing of this Network. these issues are heterogeneity, distributed process of nodes, low bandwidth, large scalability, real time consumption. Heterogeneity of nodes means that it is typical to connect with various type of nodes. Distributed processing means the algorithm need to be centralised as the process is carried on different node. Low bandwidth means the data must be transfer the sensor nodes efficiently.

## Operation challenge

There are various challenges in this type of network. challenges such as Energy efficiency, limited storage, low bandwidth, callability, nodes failure. Energy efficiency is the main issue that crates lots of hazards during transmission. Energy efficiency is usually defined as the number of bits that can be sense over a unit of power consumption which is usually quantified by bit per joule. The determining factor of energy efficiency for device is the power must be need to transmit data. Why energy efficiency; difficult to replacing the battery; lack of centralised; limited resources; selection of transmission power.

We can be save the energy at different levels such as :- at mac protocol level; at network level; at software level. As we consider at network level, we can use several routing protocol to control or save the energy of sensor nodes in the network.

## Clustering

Clustering play an important role in WSN clustering approach to use on resolving the issue like energy consumption or power limited resource. It play to increase or improve the lifetime of WSN. Methods of clustering; (1) fuzzy logic based cluster head selection. (2) hierarchal clustering. (3) estimated energy. (4) energy efficient for sensor nodes.

Clustering is used to collection the node in single set. It provide the cluster head and there cluster head transmit the data to sink or base station. The main choice for clustering is the stability ty of performance in between network. it help to ensure reliability and avoid single point failure issue. The cluster can be help to reschedule for WSN to reduce power consumption it also help to maintain the stability of node in network.

Clustering is also help to choose the one node in the clustering wich is known as cluster head CH. CH help to monitor and possess the data flow across all node in the cluster , which leads to energy is consumed less.

## Routing protocols for energy efficiency

Routing protocol is the technique which help us to save energy and some other factors also , such as; node deployment; Data designing, transmission, quality of service and connectivity.

Routing protocols depends on 3 factor; location based, data centric and hierarchal based approach.

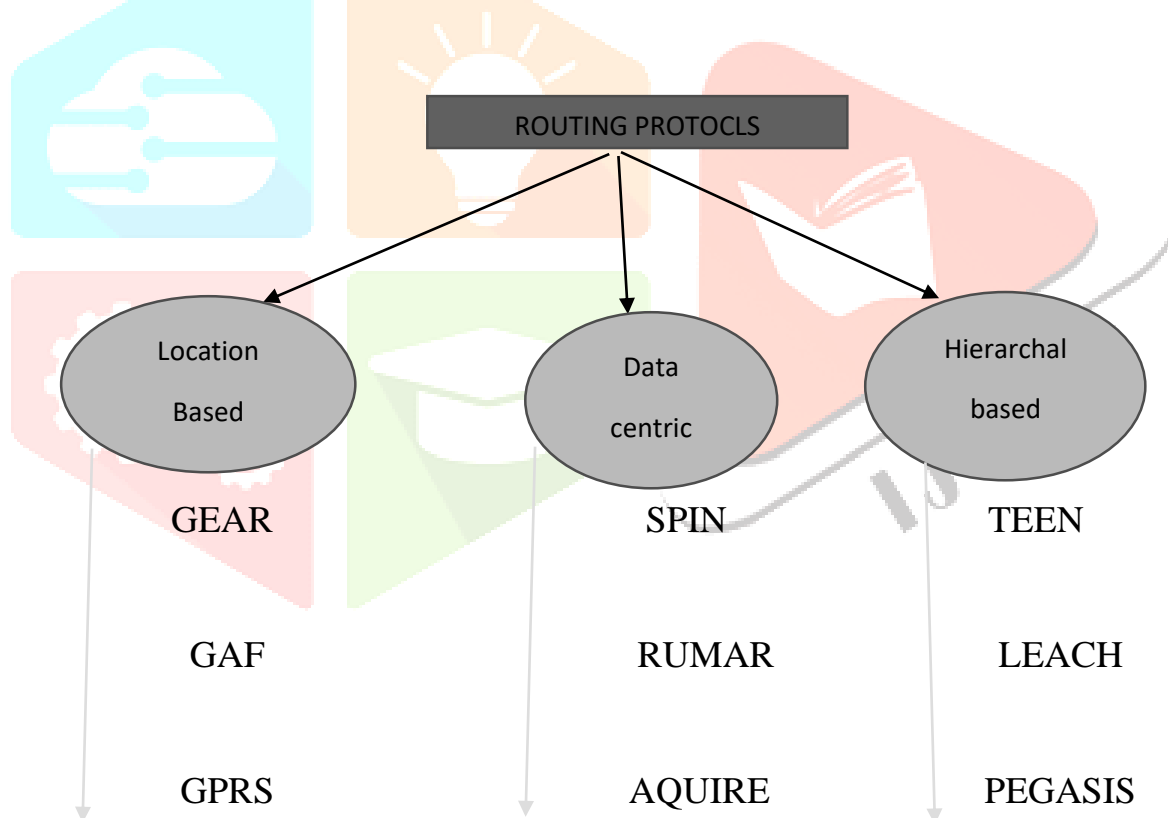


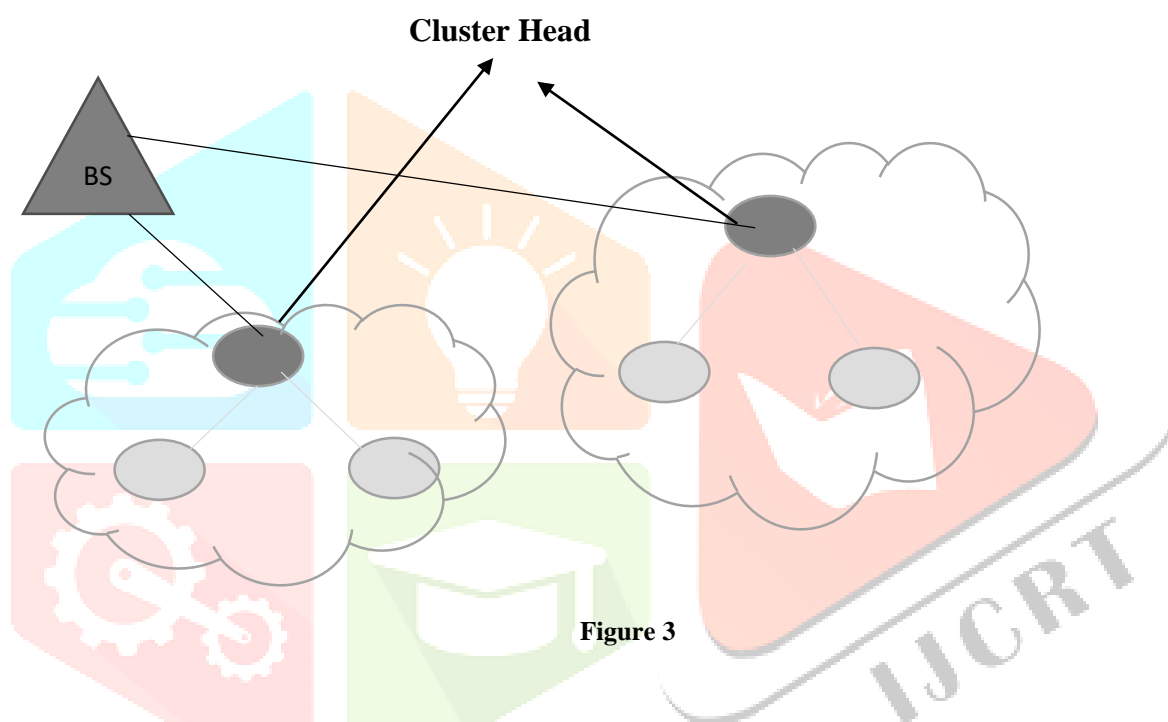
Figure 2

## Working of protocols

There are several protocols that work to save the energy of sensor nodes that based on three condition such as; location based, data centric and hierarchal based approach. Location based means nodes are manage by location. It is used to save energy it is used as nodes are not in activity then nodes will sleep, energy can be obtained by having as many sleeping nodes in network as possible. Data centric means that data is used by attribute value pairs. It is end-to- end delivery service. Hierarchal approach means higher sensing node that

have high energy that can be used to process and send the information while low energy node can be perform the sensing of the target. It is based on 2 level; clustering based and routing based.

Leach stands for Low Energy Adaptive Clustering Hierarchical Protocol. It is 2- tier hierarchal clustering architecture. It is distributed algorithm to organise the sensor nodes into cluster. It make cluster head (CH) create TDMA and CDMA schedule. It is energy efficiency data fusion. Each node transmit data into its lots. Every node sends the data to cluster head , then cluster had send the data to BS. Leach perform classical clustering algorithm by using cluster and rotating CH , tat allow energy requirement is distributed among the Network. Sensor node select themselves to be cluster head. Each node join a CH that required minimise energy. In order to balance, the energy consumption , the CH are not ixed rather than position is self elected at different time. Once all nodes are organised into clusters , each cluster head create a transmission schedule for node is cluster. It has periodic process. It is based on two phases; setup phase and steady phase.



It increases the life of network span. Distribution of energy is easily. the energy saving done to aggression by CHs. There are some disadvantages also ; it assume all node can transmit power to BS. It work on CDMA and TDMA. It works on single loop.

Pegasis stands for “Power efficient gathering in sensor Information Network”. It is improved protocol where only one node is chosen as head node, which send the fused data to the BS per rounds. There are some factors of pegasis; it is near optimal chain based protocols. It is improved over leach protocol. Each node communicates only with a close neighbour and take turn transmission to BS. Pegasis perform better than Leach.

In sensor network, data fusion help to reduce the amount of data transmitted between node to BS. Data fusion combine one or more data packet from different sensor to produce single packet. The node will receive from and transmit to each other in network gather data transfer from node to node in the network. the pegasis protocols achieved 50% to 100% improvement when 1%, 20%, 50% and 100% of node die compared to leach protocol.

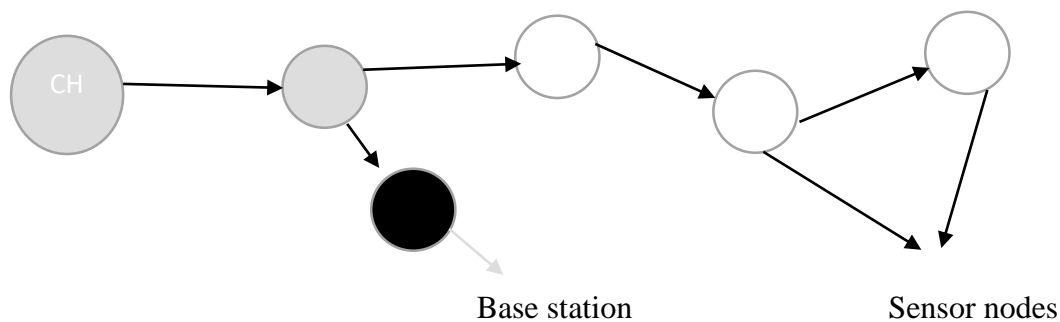


Figure 4

There are steps in Pegasus protocol; 1) chain construction- for chain , we need to transmit the data from farthest node. 2) Gathering data; all sensor node send randomly data to BS. Leader node will selected when node is die, then chain reconstructed to dead node. HN receive all the fused data and send to the BS. It is chain like structure of nodes. The transmission is take place through one to through one to another node. This was done by the help of one node which can designated to send data to BS. the leader node can be changed during transmission. The BS determine weather it is chain formation by using greedy algorithm. It required global knowledge. There are some advantage of this protocol; less number of transmission , so less loss of energy ny another node. There are some drawbacks ; (1) when head node is selected its energy level is considered. (2) there is only one head node, there might be bottle neck issue.

GEAR stands for Geographical And Energy Aware Routing. Routers packet towards a target region. Diffusion of data between nodes take place within region. It is strategy attempt to balanced network consumption and therefore it increase the lifetime of network. it performed better than connected after initial phase.

GPSR stands for General Packet Radio Services. it proposes the aggression use of geographical to chieved stability. It approaches to reduce number of states a node showed keep. It follows the parameter of the planar graph. Algorithm of GPSR is greedy forwarding and perimeter forwarding.

Teen protocols means threshold sensitive efficient sensor network. Teen protocol is the reactive clustering routing protocol, which is improved by leach. The CH collected head (CH) of each cluster data collected by its member in its cluster. CHs fuse and process data and send data to the BS.

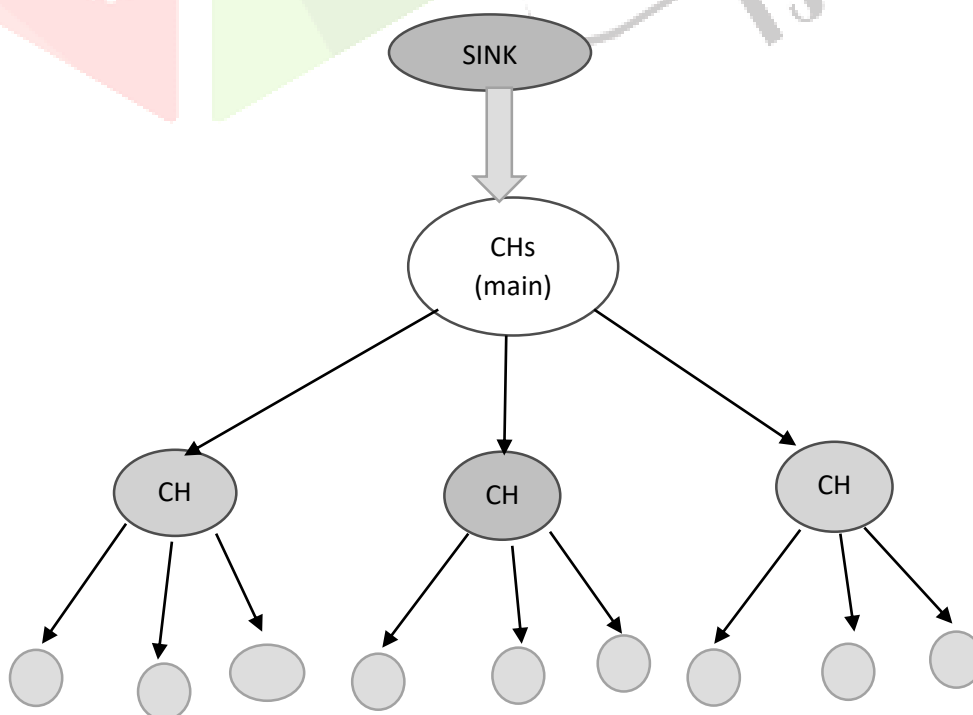


Figure 5

## AI Techniques

It is technology which enable to maintain machine to simulate human behaviour. It help to work smart work like computer that solve complex problems and issues. Machine is subset of AI which allow machine to automatically learn from part without programming. Deep learning is subset of ML in AI than network capable of learning unsuspended data from raw data. It is branch of computer science which deal with intelligence of machine where an intelligent agent is a system that take action which maximise of success. Centre knowledge o AI; reasoning, knowledge, planning and learning. AI techniques means in this we can used several AI techniques such as Fuzzy logic, genetic Algorithm and Neural Network. we used fuzzy logic because its major factor the energy consumption inn WSN. Its data collection mechanism. Fuzzy logic is wisely used to combine important parameter like residual energy, node centrality and distance to BS. For electing best suitable node as CH and increase the life of network. network.

Fuzzy logic system is a control system. This system analysis analog input value. In the term of logic variable that take continuous value between network. it control to classical or digital logic. Fuzzy logic is widely used in machine control. The term “fuzzy” refers to the fact the logic involved can deal with concept that control between expressed in form of True or false but rather as partially true.

## Working and Result

- There is network of 100\*100 nodes.
- The node distribution I uniform all over area.
- In early stage , the node is sending HELLO message to all the nodes in the Network.
- Then cluster sized is depend on the deployed nodes.
- Then the modes die, so there is re-clustering is done during which the number of cluster might merged to create more cluster.
- The consumption of energy for sending a bit data is proportional to the square of distance d between the nodes.

PARAMETER	VALUE
Network size	100*100
No. of Nodes	100
No . of Rounds	1000 J
Initial Energy	0.5 Kj

**Table 1**

## Conclusion

As we know that , energy efficiency is the main issue in wireless network. So we used several routing protocols to save the energy of sensor node. Leach is the oldest protocol that help to save the span of network, but after that we used another protocols to save the energy of nodes. Leach is first to save energy of node then we used pegasis and teen protocols that also used to increase the span of network.

## Future work

In future, we can also used pegasis and teen protocols with AI techniques. Might they give best or some improve result then leach -FL to increase or save the energy of sensor nodes of Wireless sensor Network.

## References

1. R. Jafari , A. Encarnacao , A. Zahoory , F. Dabiri , H. Noshadi , and M. Sarrafzadeh, “ Wireless sensor networks for health monitoring ” , in Proceedings of 2nd Annual International Conference on Mobile and Ubiquitous Systems: Networking and Services (MobiQuitous ’ 05) , July 2005 , pp. 479 – 481 .
2. R. F. Pierret, Introduction to Microelectronic Fabrication, Addison - Wesley, Menlo

- Park, CA, 1990
3. S. D. Senturia, *Microsystem Design*, Kluwer Academic Publishers, Norwell, MA, 2001.
  4. P. Kumarawadu, D. J. Dechene, M. Luccini, A. Sauer. Algorithms for Node Clustering in Wireless Sensor Networks: A Survey. *Proceedings of IEEE* 2008.
  5. Chang, R.S., Kuo, C.J., 2006. An energy efficient routing mechanism for wireless sensor networks. In: *Proceedings of the International Conference on Advanced Information Networking and Applications (AINA)*, Vienna, Austria, vol. 2, pp. 308312. April 1820.
  6. Maniakchatterjee, Sajal. K.das, DamlaTurgut. WCA: A Weighted Clustering Algorithm for wireless adhoc networks. *Journal of cluster computing (Special issue on Mobile AdHoc Networks)* 2002.
  7. Liyang Yu, Neng Wang, Wei Zhang, Chunlei Zheng. GROUP: a Grid-clustering Routing Protocol for Wireless Sensor Networks. *Proceedings of IEEE conference on Wireless communications, Networking and Mobile Computing (WiCOM)*, 2006.
  8. Mehmood, A.; Lloret, J.; Noman, M.; Song, H. Improvement of the wireless sensor network lifetime using LEACH with vice-cluster head. *Ad-Hoc Sens. Wirel. Netw.* 2015, 28, 1–17.
  9. Benjie Chen, Kyle Jamieson, HariBalakrishnan, Robert Morris. Span: An Energy Efficient Coordination Algorithm for Topology Maintenance in Ad Hoc Wireless Networks. *Wireless Networks* 8, 481–494, 2002, Kluwer Academic Publishers.
  10. Wang, A., Yang, D., Sun, D., 2012. A clustering algorithm based on energy information and cluster heads expectation for wireless sensor networks. *Comput. Electr. Eng.* 38(3), 662671.
  11. Mahmood, D., Javaid, N., Mahmood, S., Qureshi, S., Memon, A.M., Zaman, T., 2013. MODLEACH: a variant of LEACH for WSNs. In: *Proceedings of the International Broadband and Wireless Computing, Communication and Applications (BWCCA)*, Compiegne, France, pp. 158163. Oct.28-30.
  12. Manjeshwar, A., & Agrawal, D. P. (2001, April). TEEN: A Routing Protocol for Enhanced Efficiency in Wireless Sensor Networks. In *ipdps* (Vol. 1, p. 189).
  13. Y. Xu, J. Heidemann, and D. Estrin, “ Geography - informed energy conservation for ad - hoc routing”, *Proceedings ACM/IEEE MobiCom '01*, Rome, Italy, July 2001, pp. 70 – 84.
  14. Y. Yu, R. Govindan, and D. Estrin, “ Geographical and energy-aware routing: A recursive data dissemination protocol for wireless sensor networks”, *Technical Report UCLA/CSD - TR - 01 - 0023*, UCLA Computer Science Department, May 2001.
  15. V. Rodoplu and T. H. Meng, “ Minimum energy mobile wireless networks”, *IEEE Journal on Selected Areas in Communications*, vol. 17, no. 8, Aug. 1999, pp. 1333 – 1344.
  16. W. R. Heinzelman, J. Kulik, and H. Balakrishnan, “ Adaptive protocols for information dissemination in wireless sensor networks”, *Proceedings ACM MobiCom '99*, Seattle, WA, Aug. 1999, pp. 174 – 185.
  17. Y. Yao and J. Gehrke, “ The Cougar approach to in-network query processing in sensor networks *SGIMOD Record*, vol. 31, no. 3, Sept. 2002, pp. 9 – 18.
  18. S. Lindsey and C. S. Raghavendra, “ PEGASIS: Power - efficient gathering in sensor information systems”, *Proceedings IEEE Aerospace Conference*, vol. 3, Big Sky, MT, Mar. 2002, pp. 1125 – 1130.
  19. A. Manjeshwar and D. P. Agrawal, “ APTEEN: A hybrid protocol for efficient routing and comprehensive information retrieval in wireless sensor networks”, *Proceedings IPDPS' 01*, San Francisco, CA, Apr. 2001, pp. 2009 – 2015.
  20. D. Ganesan, R. Govindan, S. Shenker, and D. Estrin, “ Highly - resilient, energy - efficient multipath routing in wireless sensor networks”, *Mobile Computing and Communications Review*, vol. 5, no. 4, Oct. 2001, pp. 10 – 24.