

# A Survey on Energy-Efficient protocol for Wireless Sensor Networks

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## *Abstract*

Wireless Sensor Network has become one of the hot topics now a days although; it has been already applied in the use of many different areas. Such as the Home Automation, it is very common to find its use on the lighting control and security alarming. It does improve a lot on the people's living quality with a more convenient environment. In order to understand how this "Smart Innovative Technology" works, in this manner power consumption play very important role in wireless sensor network a study of the Energy efficiency in Wireless Sensor Network has been carried out in this paper. And the Study is divided in to three main parts, which are The study of clustering based energy efficiency in wireless sensor network: Here we study about clusters, cluster head and cluster member here by dividing the whole network in to the cluster and by assigning each cluster a cluster head form this technique we can save the energy of the network.

**Keywords-**wireless sensor network, clustering ,energy-efficiency, data dissemination.

## I. Introduction

Wireless Network is basically group of dedicated sensor for monitoring and recording The actual condition of the environment and Stored the collected data in the central Database for the processing wireless sensor Network measure atmospheric condition like Temperature, sound, pollution levels humidity, Water level, wind speed, and its direction. Application area of the wireless sensor Network is Enemy moment in battle field, Traffic, healthcare, industrial area wireless Sensor network can have multiple sensors nodes and have equipment like antenna radio transceiver a micro controller and interfacing electronic circuit and

energy source as well size of the sensor vary according to need and price depend on the functionality of the sensor we can say energy consumption memory speed rate Bandwidth etc. Wireless sensor network is supposed to operate unattended for a long time after deployment in the cluster each cluster contains one cluster head (CH) and many cluster member (CM's) all the cluster member are one hop away from the respective CH's all the cluster member are connected with its own CH to transmit/receive packets (CH) communicate each other in cyclic super frames manner. Have you ever imagined that thousands of sensor are deploy in a specific area and all of these are well coordinated in a network without the data transmission delay or jam these sensor node detect the physical movement, or physical changes like temperature, humidity, light intensity and gather information according to their changes and send it to the base station (BS) in the form of data signal for processing.

**Sensor Node:** A sensor node is the main component of a WSN. Sensor nodes take multiple roles in a network, like as simple sensing, data storage, routing, and data processing.

**Clusters:** Clusters are the organizational unit for WSNs. The dense nature of these networks requires them to be broken down into clusters so that task can be simplified for a communication.

**Cluster heads:** Cluster heads are the organization leader of a cluster. They required to organize activities in the cluster. These tasks include but are not limited to data-aggregation and organizing the communication schedule of a cluster.

**Base Station:** The base station is at the upper level of the hierarchical WSN. It provides the communication link between the sensor network and the end-user.

End User: The data in a sensor network can be used for a wide-range of applications. Therefore, a particular application may make use of the network data over the internet, using a PDA, or even a desktop computer. In a queried sensor network (where the required data is gathered from a query sent through the network). This query is generated by the end user. The clustering phenomenon as we can see plays an important role in not just organization of the network, but can dramatically affect network performance. There are several key limitations in WSNs, that clustering schemes must consider.

Limited Energy: Unlike wired designs, wireless sensor nodes are "off-grid", meaning that they have limited energy storage and the efficient use of this energy will be vital in determining the range of suitable applications for these networks. The limited energy in sensor nodes must be considered as proper clustering can reduce the overall energy usage in a network. Network lifetime the energy limitation on nodes results in a limited.

Network lifetime: For nodes in a network. Proper clustering should attempt to reduce the energy usage, and hereby increase network lifetime.

Limited Abilities: The small physical size and small amount of stored energy in a sensor node limits many of the abilities of nodes in terms of processing and communication abilities. A good clustering algorithm should make use of shared resources within an organizational structure, while taking into account the limitation on individual node abilities.

Where wireless sensor network can be found

Wireless sensor network has already been widely used in different areas for current development application.

Habitat monitoring: such as the monitoring of water /air pollution and the temperature humidity measurement.

Military: use here we talk about monitoring the actual battle condition by installing the sensor on the army and weapons.

Biomedical use: here we collect the physiological data from the human body or medical diagnosis.

Home automation: here we control lighting and security alarming in home.

Other commercial application: like product quality control on the manufacturing production.

Characteristics of wireless sensor network

- ✓ It has limited energy
- ✓ failure due to depleted batteries or Environmental influences
- ✓ Limited size and energy restricted Resources
- ✓ Node mobility ,node failure andEnvironmental obstruction
- ✓ Scalability issues
- ✓ Wireless Sensor Networks (WSN) are Ad hoc networks (wireless nodes that self-organize
- ✓ In to an infrastructure less network)
- ✓ WSNs have many more nodes and are more densely deployed
- ✓ Sensing and data processing are essential
- ✓ Hardware must be cheap
- ✓ WSNs operate under very strict energyConstraints
- ✓ The communication scheme is many-to-one (data collected at a base station) rather than peer-to-peer
- ✓ Bandwidth and resources scale with network size.

Unique characteristics of a wireless sensor network

- ✓ Small –scale sensor nodes
- ✓ Limited power they can harvest orStore
- ✓ Harsh environmental conditions
- ✓ Mobility of nodes
- ✓ Dynamic network topology
- ✓ Communication failures
- ✓ Large scale of deployment
- ✓ Unattended operation

## II. Issue in wireless sensor network

- ✓ The major issues that affect the design and performance of a wireless sensor network
- ✓ Hardware and Operating System for WSN
- ✓ Wireless Radio Communication Characteristics
- ✓ Medium Access Schemes
- ✓ Deployment
- ✓ Localization
- ✓ Synchronization
- ✓ Data Aggregation and DataDissemination
- ✓ Database Centric and Querying Architecture

- ✓ Programming Models for Sensor Networks
- ✓ Quality of Service
- ✓ Security

### III. Related work

C. guo et al (2007) [1] proposed analysis and optimization of Energy Efficient Cluster Forming for Wireless Sensor Networks in this scheme author proposed Wireless sensor network operate longer duration as much as possible before battery Replacement characteristics of the wireless sensor network must be self-organized and energy efficient one way is to divide the wireless sensor network in to clusters where each cluster is managed by cluster head which covers the no of cluster member.

H.Jiang et al (2011) [2] proposed prediction or not? an energy-efficient framework for clustering-based data Collection in Wireless Sensor Networks.in this scheme author describing that how can we apply prediction and clustering techniques to gather accurate data from the sensor .In this application of wireless sensor network user extract data from the network so that analysis can be done later on it is difficult to extract accurate data and obtain the sensor reading is too costly clustering and prediction techniques find the temporal correctness between the sensor data provide chance to reduce the energy consumption for continuous sensor data collection prediction and clustering techniques makes it necessary to design a new data collection scheme to achieve network energy efficiency we developed clustering base framework as we know cluster head represent the node in the cluster and collect data value from them. After analysing the performance between reducing the communication cost and the prediction cost we design an algorithm that can find the benefits of adaptive scheme to enable/disable prediction operation we incorporate the sleep/awake feature so that energy can be save when node is not in use .it avoid the concept of node to node propagation so that energy can be save we take framework approach and design an algorithm so that cluster to cluster transmission can be done.

Y.Jin et al (2011) [3] Author have proposed a distributed energy-efficient re-clustering Solution for Wireless Sensor Networks in this scheme author proposed that how can we save energy of the wireless sensor network by applying re-

clustering algorithm clustering algorithm is widely used in WSN but it is not that much efficient to save that much amount of energy which re-clustering can save. So here we proposed a new re-clustering scheme which is used to balance the work load and cluster recognition by selecting the different CH's however number of control messages is send using this process which consume on board node energy so in this case how network should perform re-clustering in this paper a distributed re-clustering solution is proposed which provide energy efficiency re-clustering rate to save node energy and it balance the nodes energy consumption across the network this re-clustering algorithm calculate the energy required to recognized the cluster and to deliver the sensory data in this case frequency of re-cluster operation is obtain which reduces control message overhead .in the first work that analytically analyses the overhead in re-clustering a WSN group these re-clustering round to reduce overhead and at the same time so it balance the node life time.

B.Nazir et al (2010) [4] have proposed energy balanced clustering in wireless sensor network In this paper author proposed schemes of energy balanced clustering so from this scheme we can balance energy in the whole network so to balance the energy in the wireless sensor network author proposed an algorithm to form energy balance clusters cluster head (CH) selection intra cluster and inter cluster communication in wireless sensor network are proposed and author compare this protocol with LEACH & EEMC using parameter like energy/packet and throughput. A standard architecture of wireless sensor network proposed random deployment of sensor nodes near base station (BS)/sink is placed and BS further communicate to the internet.

A.chaman et al (2009) [5] have proposed a distributed energy-efficient cluster formation Protocol for Wireless Sensor Networks in this scheme. The main concern to design wireless sensor network is to minimize energy consumption and maximize network life time using clustering technique we can achieve the less energy consumption in the wireless sensor network .since data processing filtering routing and relaying are operated only by cluster head (CH) this will reduce the network load and alleviating the bandwidth here we propose a scheme of selecting a cluster head (CH) .CH selection eligibility scheme is based on its residual energy and its degree we know that

wireless sensor network deploy to detect and report event like presence, movement or intrusion where human presence is impossible so we need to design such a wireless sensor network that consume less energy to processing its data and work for very larger time without replacement its battery very frequently.

Clustering techniques: Divide the whole sensor network in to small groups is called clusters the resign behind to implement cluster scheme is to improve the scalability of the network and most important factor is to reduce energy consumption within the network apart from this it has advantage like less consumption of bandwidth within the clusters and localizing energy-efficient route setup within the clusters there are some of energy-efficient routing protocols based on the clustering are like LEACH, HEED, TEEN, EBC etc.

LEACH [10] Low energy adaptive clustering hierarchy uses the clustering techniques to distribute the energy consumption all along its network in this protocol data is to be collected whole network is divided in to clusters and cluster head , cluster head are elected randomly there are some step which involve in each step in LEACH protocol.

Advertisement phase: in the first step of LEACH protocol eligible CH will be issuing a notification to the node which is coming under its range to become a cluster member in its cluster .the node accept the offer based on the receiving signal strength.

Cluster set-up phase: in this phase node will respond to their selected cluster head.

Schedule creation: in this step cluster head have to make a TDMA scheme and send back to its cluster members to initiate them when they have to pass their information to it.

Data transmission: in this step data collected form the individual sensors will be given to the cluster head during its time interval and the entire remaining time cluster member will be in sleep mode to reduce its energy consumption.

HEED [9] LEACH protocol is much energy-efficient but the main drawbacks in this approach is it selects cluster head randomly so it takes more energy to select cluster head in each time to avoid random selection of cluster head a new algorithm was developed which select the cluster head based

on the its residual energy and communication cost. This protocol executed in some phases.

Initialization phase: during this step the Initial CHs node percentage will be given to the nodes each node computes its probability to become CH.

Repetition phase: until the CH found with least transmission cost this phase continuously repeated if node cannot be able to find appropriate CH. Then the concern node itself acts as a CH.

Finalization phase: the selection of CH will be finalized here. The tentative CH now becomes the final CH node.

TEEN [11] a routing protocol for enhanced efficiency in WSN. In which the classification is based on the routing that are as proactive and reactive networks. In this scheme a TEEN (Threshold Sensitive Energy Efficient Sensor Network) protocol that is implemented for reactive network. In which the overall performance of protocol is depending for a simple temperature sensing applications.

Hard threshold: this value is used for the sensed attribute. It is the predefined value for attribute after sensing that value the node switch to transmission mode and report to its cluster head.

Soft threshold: in this scheme the small change on value of sensed attribute after the node release to switch on transmitter and transmit the information.

EBC[4] Energy balance clustering in this scheme we can balance energy in the whole network to balance the energy EBC algorithm is proposed which form energy balance clusters. Cluster head selection, intra cluster and inter-cluster communication in wireless sensor network are proposed which save the energy consumption and we compare this scheme with LEACH and EEMC using parameter like energy/packet and throughput etc. A standard architecture of wireless sensor network proposed random deployment of sensor nodes near base station (BS)/sink is placed and BS further communicate to the internet.

Group [8] the group algorithm is a grid-based clustering algorithm in this algorithm one of the sinks (called the primary sink), dynamically, and randomly build the cluster grid the cluster heads are arranged in a grid-like manner forwarding of data queries from the sink to source node are propagated from the grid seed (GS) to its cluster heads and so

on the GS is a node within a given radius from the primary sink. In terms of cluster head selection on a given round the primary sink seen a given round the primary sink selects a GS based on residual energy. Once the GS has been selected, the GS selects cluster-heads along the corners of the grid at a range R. Each new cluster-head will then select more cluster-heads along the grid until all cluster-heads have been selected. These selections are based on the residual energy of nodes near the corners of the grid. Data transmission in GROUP is dependant on the type of data being collected. In the case of a location unaware data query (data that is not dependant on the location of the sensing node), the query is passed from the central most sink in the network to its nearest cluster-head. That cluster head will then broadcast the message to neighbouring cluster-head. If the data is location aware, then the requests are sent down the chain of cluster-heads towards the specified region using unicast packets. For both data queries, data is transmitted upstream through the chain of cluster-heads established during cluster formation. Energy conservation is achieved due to the lower transmission distance for upstream data. In LEACH, a cluster-head must transmit data to the base station directly [7], while in GROUP, the data is transmitted across short ranges through the upstream path. [8]

Table no.1 comparison between different

Routing protocol	classification	Power usage	Cluster stability	QoS
LEACH	hierarchical	High	Moderate	No
HEED	hierarchical	High	Good	No
TEEN	hierarchical	High	Good	No
EBC	hierarchical	Medium	Moderate	No

#### IV. Conclusion

Thus the existing clustering strategies in the wireless sensor network and their corresponding protocol like LEACH HEED TEEN EBC explained and EBC are proved to be energy-efficient than the previous model.

#### V. References

[1] Cheng guo,Ramin Hekmat and Przemyslaw Pawelczak:2007. Analysis and optimization of

- Energy Efficient Cluster Forming for Wireless Sensor Networks 127-132
- [2] Hongbo Jiang, Member, IEEE Shudong Jin ,Member,IEEE,and chonggang Wang,Senior Member,IEEE:2011. Prediction orNot? An Energy-Efficient Framework for Clustering-Based Data Collection in Wireless Sensor Networks 1064-1071.
- [3] Yichao Jin1 ,Dali Wei2 ,Serdar Vural1 ,Alexander Gluhak1 and Klaus Moessner1:2011 A Distributed Energy-efficient Re-clustering Solution for Wireless Sensor Networks.
- [4] Babar.Nazir1,Halabi.Hasbullah2:2010Energy Balanced Clustering In Wireless Sensor Network.
- [5] Ali.chaman and Samuel Pierre:2009 A Distributed Energy-Efficient Cluster Formation Protocol for Wireless Sensor Networks 1-5.
- [6] M. Ye, C. Li, G. Chen, and J. Wu, EECS:2000 An Energy Efficient Clustering Scheme in Wireless Sensor Networks, National Laboratory of Novel Software Technology,Nanjing University,China.
- [7] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan:2000 “Energy- Efficient Communication Protocol for Wireless Sensor Networks,” Proceedings of the 33th Hawaii International Conference on System Sciences,.
- [8] L. Yu, N. Wang, W. Zhang, and C. Zheng, GROUP: A Grid-Clustering Routing Protocol for Wireless Sensor Networks, East China Normal University.
- [9] O.Younis and S. Fahmy, HEED:2004 a hybrid ,energy-efficient,distributed clustering approach for ad hoc sensor network, IEEE transactions on mobile computing ,vol. 3,no.4, pp 366-379,oct-dec.
- [10] W.Heinzelman,A.P.Chandrakasan, H.Balakrishnan:2002 Application specific protocol architecture for wireless microsensor networks, IEEE Transactions on WirelessNetworking .
- [11] Arati Manjeshwar and Dharma P. Agrawal.”TEEN: A Routing Protocol for Enhanced Efficiency in Wireless Sensor Networks”.