A Survey: Energy Efficient Approach in WSN

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Abstract - **Wireless Sensor Network is the collection of tiny sensor nodes which are commonly used to collect information and data from different target areas. WSN is very useful to be used in the area where traditional wired or wireless network is difficult to be deployed. Current era, WSN is more useful in real-time applications. There are some resource consumption challenging issues like bandwidth consumption, energy consumption and installation cost. In WSN, sensor nodes have low power capabilities with small batteries, so it require energy efficient routing algorithms which can reduce the energy consumption, increase the network lifetime, throughput. Wireless Sensor Networks consist of small, low-power, low-energy nodes used for monitoring environmental parameters such as temperature, humidity and motion. Each energy efficient approach available in lifetime has its own advantages over the other energy efficient approaches. This paper gives an overview of the different routing strategies used in wireless sensor networks and gives a brief working model of energy efficient routing protocols in WSN. We have also compared these different routing protocols based on metrics such as mobility support, stability, overlapping. The study concludes with the recommendations to the future direction in the energy efficiency model for the sensor networks.**

Index Terms – **Wireless sensor network, Clustering, Energy efficient, Routing**

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1. INTRODUCTION

The rapid growth of technology has given rise to a new class of distributed systems known as Wireless Sensor Networks (WSNs). A WSN consists of hundreds to thousands of sensor nodes, that have the ability to communicate among themselves using radio antenna. These nodes are usually small in size with limited processing power, limited memory and limited energy source. Hence they all work together in collaboration as a network towards achieving a common goal of sensing a physical parameter over a large geographic area with greater accuracy. Because they are amenable to support a variety of real-world applications the WSNs are considered as powerful sensing network to the present day world.

A Wireless sensor network (WSN) consist many number of wireless sensor nodes. All nodes are deployed in the geographical area and used to control and locate the area. Nodes have power module that are integrated with sensor module. Sensor module sense the data and data go to the processing module. It also have short range radio communications. All the sensed data that are sensed by sensor are go to the source by base station. The large number of nodes are spread across geographical area, all nodes are communicating with each other and send data to the sink node. Sink node is called base station. Sink node send data to the source via internet. Source node process sensed data further.

1.1 APPLICATION OF WSN

- **Environment Management**

  There are many applications in monitoring environmental parameter . Sensors sense the environment and send that data to the base station, that are control by source. so, its useful in the environment management.

- **Military Monitoring**

  In sensor network many services provided in military like data collection, surveillance of area, detection of intrusion and attack detection. In this area the sensor network application have some advantage than other network because emery attack can destroy or damage some nodes but failure of nodes in sensor network not affect the whole network.

- **Real time traffic monitoring**

  In the real time traffic monitoring the sensor nodes to calculate the average speed of the vehicles which transit over a roadway by taking the time mark at two different points. So, it is very useful in real time traffic monitoring.

- **Health Application**

  In the medical application the wireless sensor network used for body position measurement, person's location, monitoring patients in homes or hospitals. There are various application that are used for monitoring human's inside body.

- **Fire detection**

  The nodes are installed in the area and detect the fire when fire has started. The sensor are equipped with the nodes that measure the temperature, humidity and gases that produce during fire. The early detection of fire and action of fire-fighters to WSN, the fire brigade able to know when fire started and how spread.

- **Humidity**

  Humidity sensors are used to detect moisture content, agricultural applications. It also play important role in measure soil water tension. The humidity sensors are intelligent so it consist micro controller, power supply etc. it also used to measure electrical capacitance.

- **Habitat monitoring**

    WSN is largely used for wild life research activities. By this research behavior of the birds is studied. It is used for detection of the endangered species.WSN is used for other activities like find location, migration pattern of the birds and animals, hunting behavior, population etc.

1.2 LIMITATION OF WSN

- **Limited Resources**

    All broadcasting mechanism needed certain resources for implementing, data memory, computation etc. In current these all resource are very limited in tiny sensor network.

- **Limited Memory and Storage Space**

    A sensor is a small size device with only a small amount of memory and storage space. In building effective mechanism it is necessary to limit the size of code for algorithm.

- **Power Limitation**

    Energy is the biggest issue in WSN. It's hard to replace and recharge the node after deployed in area.. When implementing sum or probability function or protocol within a sensor node, the energy impact of the added broadcasting code must be considered.

- **Limited Computation**

    The processors that are used in the wireless sensor network is not powerful like wired network. Hence, Complex cryptographic algorithms cannot be used in WSNs.

- **Limited Communication Range**

    The transmission range of sensor nodes is limited which leads to unreliable transfer of data. Sometimes this results in damaged packets or appears sensor nodes in out of range.

2. ROUTING APPROACH IN WSN

Clustering Approach

Sensor network is divided into small units is called as clustering. Though the main reason behind the implementation of the clustering scheme is to improve the life time of the network, it is an important factor in achieving energy efficient routing of data within the network. Apart from achieving scalability of the network it has more advantages like conserving communication bandwidth within the clusters, avoiding redundant message transfer between the sensor nodes, localizing energy efficient route setup within the clusters. Some of the energy efficient routing protocols based on clustering are LEACH, HEED etc…

Tree Based Approach

Apart from clustering techniques in WSN, another energy efficient way of routing the data over the network is tree based approach. In this approach a hierarchical manner is used for sending data to the BS. The leaves are the source nodes and the root is the sink node. The data when travelling gets aggregated in the intermediate nodes itself. PEGASIS is most successful energy efficient routing protocol which follows the tree based.

2.1 REASONS FOR WASTING ENERGY

- **Crash**

    All the packets will be crashed, when a node obtains more than one pack at the similar time. All packs that grounds the smash have to be castoff and the retransmission of these packs is obligatory.

- **Overhearing**

    In Sensor Wireless Networks explains that "when a sender transmits a packet, all nodes in its transmission range receive this packet even if they are not the intended destination. Thus, energy is wasted when a node receives packets that are destined to other nodes."

- **Control Packet Overhead**

    To enable data transmission, the minimal number of control packets should be used. In Idle Listening it's occurred, when a node listens to an idle channel to get probable traffic. It is considered the biggest source of energy wastage.

- **Interference**

    Wireless sensor Networks explains that "each node located between transmission range and interference range receives a packet but cannot decode it."

3. RELATED WORK – LITERATURE SURVEY

LEACH

All nodes are distributed in the cluster. Cluster has one cluster head and that send data to the base station. The operation of LEACH protocol is broken up into rounds. There are two phases in LEACH. Steady State phase and set up phase. Set up phase consist three phase. Advertise phase, cluster set up phase and broadcast schedule. In the set up phase the random number is generated. That is between 0 and 1. If random number is less than Threshold value the node become cluster head. In steady state phase time slot is decided based on TDMA fashion.

LEACH includes distributed cluster formation, multiple round and randomly rotation of the CH. So that, these all features used for achieving the desired properties for energy efficient routing.

A Novel Cluster Head Selection Method for Energy Efficient

In this paper proposed technique, Front Leading Energy-Efficient Cluster-Heads (FLEECH) is an improvised model in comparison to LEACH protocol. Primarily the selection of a node as a CH depends on the following criteria.
• Distance to base station
• Average distance to other nodes in the same cluster
• Residual energy level of the node
The objective of selection of such a CH is to substantially reduce the energy consumption due to intra-cluster communication, to balance the residual energy level and consequently to increase the network life proportionately.
The CH of a cluster is selected by considering the residual energy of the sensor nodes with a threshold limit, distance from the sink node, and average distance from the group members. The CHs utilize the services of high-energy base station to perform most energy-intensive tasks.

An improved leach protocol for indoor wireless sensor networks
In this research paper Energy Efficient LEACH protocol is specially purposed for critical applications like poisonous or explosive gases existing in the environment should be detect before reaching dangerous level and certain precaution should be taken immediately .It divided into four phases.
All Sensor nodes are manually deploy into each room on floor of buildings. Each floor are determine as cluster. All nodes have specific ID. CH candidate node sends their current energy information with their ID to base station. Base station chooses the highest energy node as a cluster head. The Upper and Lower threshold are fixed. Lower threshold is sensed by application called lower threshold and data closed to dangerous level that called Upper threshold. If the data are close to upper threshold it sends directly to the BS without waiting of CH. Its guaranty for not duplicate the data to the BS from CH by X-OR operation.

Smart Cluster Head Selection Scheme
Smart Cluster Head Selection Scheme energy efficient protocol is used for energy consumption and increase the life time of the network. There are divided into two phase. 1) Set up phase 2) Steady state phase
In SCHS protocol network is divided into a two area. One is border area and inner area. Border distance is fixed that is d. If d is small it is become more energy efficient. In set up phase First check that is border area node or not. Nodes that are in border area are never become a cluster head. If there is inner area node the CH announce the status to member node. Member node accepts the request. Then send the response to CH. CH node accept response. After that CH compile TDMA schedule and send data. Member node receive TDMA schedule. In steady state phase, all nodes sense the data and then that send to CH. CH aggregate the data. After that data send data to the base station. It sends the data up to round trip time is over. If the round trip time is over the set up phase performed.

Energy Efficient Cluster Based Routing Protocol
Energy Efficient Cluster Based Routing Protocol deals with cluster formation based on different events. After that cluster head is selection, then aggregation of the sensed data within a cluster and sending that to the base station in an energy efficient performs more efficiently.
The protocol can be divided into four modules: The cluster formation phase, cluster head selection phase, the sensing and to the base station.

$$W_{ij} = k_1 * \left(\frac{ER_j * N_j}{DB_j^2 * CR_j * load_j} \right)$$

Erj- Residual energy,
Nj- No of adjacent node,
DBj- Distance between node to base station,
CBj - Rate of energy consumption,
Load- Number of packet that already sent to   node
The weight time is calculated by these parameter. This algorithm to be capable of sending information to the base station in energy efficient way as well as in minimum time.

Energy Efficient Grid Based Clustering and Routing Algorithms for Wireless Sensor Network
The basic idea of the proposed clustering and routing algorithms are as follows. We first divide the whole region into several grids, each of equal size. This division is based on the transmission range of the sensor node, which is explained later. Each grid forms a cluster. In each cluster, we select a normal sensor node as the CH, which has minimal distance from other sensor nodes within the cluster and has residual energy more than threshold value. In order to avoid the delay of data transmission and the consumption of more energy, CHs communicate with sink through CHs which are closer to the sink. Our algorithm works in rounds. Every round is divided into following steps: initialization phase, set-up phase and routing phase which are described subsequently. The initialization phase deals with the construction of the grids, the set up phase with the CH selection and the routing phase with the proposed multi-hop routing for forwarding the data from CHs to the sink.

Shows the summary of the comparison of hierarchical routing schemes

Scheme	Advantages	Drawbacks	Scalability	Mobility	Route Metric	Periodic Message Type	Robust
LEACH	Low energy, ad-hoc, distributed protocol	It is not applicable to networks deployed in large regions and the dynamic clustering brings extra overhead	Good	Fixed BS	Shortest Path	None	Good
LEACH-C	The energy for data transmission is less than LEACH	Overhead	Good	Fixed BS	The best route	None	Good
PEGASIS	The transmitting distance for most of the node is reduced	There is no consideration of the base station's location about the energy of nodes when one of the nodes is selected as the head node	Good	Fixed BS	Greed route selection	None	Good
TEEN	It works well in the conditions like sudden changes in the sensed attributes such as temperature	A lot of energy consumption and overhead in case of large network	Good	Fixed BS	The best route	None	Limited
APTEEN	Low energy consumption	Long delay	Good	Fixed BS	The best route	IMEP Control	Good
VGA	It may achieve energy efficiency and maximization of network lifetime	The problem of optimal selection of local aggregators as master aggregators is NP- hard problem	Good	No	Greed route selection	None	Good

4. CONCLUSION

In this paper we have studied about wireless sensor network. We have studied about application of WSN, limitation of WSN, etc.. We have described different energy efficient routing strategies in wireless sensor network. We have done literature review of new energy efficient routing technology and new energy efficient research paper. We have compared different energy efficient routing protocol based on scalability, mobility, robust. So, Our research focus is based on finding new energy efficient approach in wireless sensor network.

5. REFERENCES

[1] GauravKhatana, Manju "Energy Efficient Algorithm for Routing Problem in Wireless Sensor Networks" IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE-2014),May 09-11, 2014, Jaipur, India

[2] A Survey by Nikolaos A. Pantazis, Stefanos A. Nikolidakis and Dimitrios D. Vergados, Senior Member "Energy-Efficient Routing Protocols in Wireless Sensor Networks", IEEE, SECOND QUARTER 2013

[3] Xiaoyan Cui " Research and Improvement of LEACH Protocol in Wireless Sensor Networks" International Symposium On Microwave, Antenna, Propagation and Emc Technologies For Wireless Communications@ IEEE 2007

[4] Abdullah Erdal TÜMER &Mesut GÜNDÜZ "An improved leach protocol for indoor wireless sensor networks", 978-1-4799-2866-8/14/$31.00 ©2014 IEEE

[5]Vipin Pal, GirdhariSingh ,Rajender Prasad Yadav" SCHS: Smart Cluster Head Selection Scheme for Clustering Algorithms in Wireless Sensor Networks " at Published Online November 2012

[6] Sohini Roy, Ayan Kumar Das "Energy Efficient Cluster Based Routing Protocol (EECBRP) for Wireless Sensor Network" First International Conference on Networks & Soft Computing@2014 IEEE

[7] SrikanthJannu, Prasanta K. Jana "Energy Efficient Grid Based Clustering and Routing Algorithms for Wireless Sensor Networks" 2014 Fourth International Conference on Communication Systems and NetworkTechnologies (IEEE)

[8] Basanta K. Nayak, MonalisaMishara, SatyanandaChampatiRai,Sateesh K. Pradhan "A Novel Cluster Head Selection Method for Energy Efficient Wireless Sensor Network" 2014- 13th International Conference on Information Technolo(IEEE)

[9] M. Al Najjar et al., Video Surveillance for Sensor Platforms: Algorithms and Architectures, Lecture Notes in Electrical Engineering 114, DOI 10.1007/978-1-4614-1857-3_2, © Springer Science+Business Media, LLC 2014

[10] http://en.wikipedia.org/wiki/Wireless_sensor_network