An Approaching of Energy Management Routing Protocols in Wireless Sensor Network

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Abstract - *A Wireless Sensor Network (WSN) consists of large amount of sensor nodes which are responsible for gathering and aggregation of sensation data to transfer from a source node to a destination node. The sensor node contains a storage device, a computing device and a battery. Limited power-battery life of sensor nodes is the main issue in Wireless Sensor Networks. Routing protocols are used in the wireless sensor network for routing data from one node to other node. There are several methods are used for lower down the power utilization in a network. In this paper, different energy efficiency routing protocols are analyzed for a wireless sensor network.*

Key Words: **Wireless Sensor Network, Energy Efficiency, Routing Protocols, Cluster Heads, Clustering**

1. INTRODUCTION

A wireless Sensor Networks consist a large amount of self-governing sensor nodes which are responsible for monitoring the environmental conditions such as pressure, temperature, etc. The main elements of a wireless sensor network are a sensor device for sensing, a CPU for processing data, a power device for power supply and a communication device for communication in a network. The main function of the sensor nodes is data gathering and data aggregation. Wireless Sensor Network having capability of self- maintains/organize when in the case of any node failure. The data which is sensed by the sensor nodes is processed at node level and transfer to sink or base station (BS). Each sensor node consist various types of memory, RF transceiver, power source, microcontroller and various actuators.

Routing technique is used for as a propagation technique between various hops in the network. Wireless Sensor Network is very helpful in monitoring in those areas where human power is not possible. Wireless Sensor Network having potential for providing low cost solution in military problems, environmental condition, health condition and climate condition. But the sensor networks having limited power storage and memory capacity and this is the main issues in the wireless sensor network. Most of the techniques and research work shows that the conservation of energy in sensor nodes helps for increasing the lifetime of a network. The main requirement of the wireless sensor network applications are scalability, prolong lifetime of a network,

reliable data transfer rate, energy conservation of a node, etc.

The architecture of wireless sensor network is shown in Figure 1; which includes a large number of sensor nodes in a field known as wireless sensor network. The entire sensor node collects data from other nodes and forwarded the data to the base station/sink/gateway for processing of the collected data. In recent years, many protocols and algorithm are proposed which maintains energy level in a network. The cluster based routing model is more superior to other non-clustering routing model. This paper provides a review of various energy efficiency routing protocol in wireless sensor Network and also analysing these protocols.
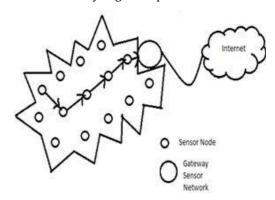

Fig-1: Wireless Sensor Network Architecture

2. LITERATURE REVIEW

Researchers are designing new algorithms or proposing modifications in existing algorithms to increase energy efficiency during communications between nodes. Anshuli Raina and Shonak Bansal proposed that the usage of combination of algorithms gives the better result as compare to the other existing techniques which are mostly used in a wireless sensor network.

Dian Palupi Rini, Siti Mariyam Shamsuddin and Siti Sophiyati Yuhaniz proposed that the little improvement in the leach algorithm increases the lifetime of a sensor node and power consumption [1]. Nikolaos and Dimitrious D. Vergados proposed that fundamental concepts about power management, including the necessity of power management for a wireless sensor network, and the side effects as well as the cost of power management [2]. Lu Jianyin proposed by

analysing the sensor network routing protocol improves the consumption of energy by using certain parameter of the routing algorithm [3]. Utpal kumar paul and Sudipta Chattopadhyay proposed that dividing the network area into grid shaped by using the grid based routing algorithm, consumes less energy during communication transmission between nodes in the network [4]. Shounak Chakraborty and Ajoy Kumar Khan proposed that energy is conserved by using hierarchical model according to the data and query based [5].

The main motive by survey all the research paper is that improvement of routing algorithms increases the network lifetime and consumes less energy by a node.

3. CLASSIFICATION OF ROUTING PROTOCOL

Routing protocol is a very important part of a network which helps to find out the best routing path for transmitting the data from one node to other node. There are various types of routing protocol which are categorized as below figure.
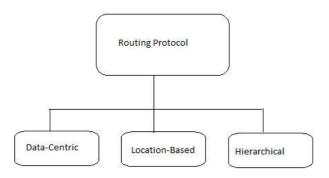

Fig -2: Classification of Routing Protocols

3.1 Data Centric:
A data centric routing protocol is a query based routing protocol and there dependency is based on the naming of the desired data. By using this desired data, it eliminates the redundant transmission data. In this, a base station sends queries to a particular area and waiting for information which are reply from sensor nodes of a particular area. The most required information is send by the sensor node to the base station and reduces the power consumption during transmission of data. E.g. SPIN

3.2 Location Based:
Location based routing protocol is based on needs an information of a particular region of a sensor nodes in a network. The information can be collect from GPS (Global Positioning System) signals, received radio signal strength, etc. An optimal path is constructing by using the location information without using any coding techniques. E.g. GEAR

3.3 Hierarchical Based:
Hierarchical based routing protocol is an energy efficient routing i.e. using two methods for transmitting the data in a network. It uses higher energy nodes for process and sends

the information and lower energy nodes are used to perform the sensing in the demanding area. E.g. LECH, TEEN, APTEEN

4. EXISTING ROUTING PROTOCOLS

There are various types of existing routing protocols which are using mostly in a network. These protocols are discussed as below:

4.1 LEACH (Low Energy Adaptive Clustering Hierarchy):
LEACH is a hierarchical based routing protocol which is mostly used in a wireless sensor network. It has an advantage of self-adaptive and self-organized, so easily establishing a network. It uses two rounds i.e. cluster set-up stage and steady state which are helpful in reducing unneeded energy costs.
In set-up phase, cluster heads (CH) are selected from each cluster in a network and the selection of cluster heads is done by using certain probability at a time. During selection procedure each sensor node generates a random number which are in between 0 and 1. If a random number is lower than the threshold value then the node which having lower threshold will become a new cluster head of a particular cluster.
In steady-state phase, each node in the network is allotted with the time slot using TDMA. Using this time slot, a node is capable for transmitting data to cluster head (CH). After obtaining data from nodes, it aggregates the data and compressed and sends to the base station.
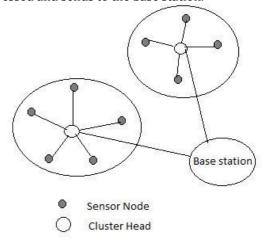

Fig -3 Clustering in LEACH protocol

4.2 PEGASIS (Power efficient Gathering Sensor Information System):
PEGASIS protocol is a chain-based power efficient and it is based on LEACH. In this protocol, the nodes in the network maintain all the information of other nodes and also have the capability of sending data directly to the base station (BS). It assumes that the node carry same amount of power level and the entire node are expires at the same time. The construction of the chain is made by using greedy algorithm.

Here, the construction of chain is made at that node which is far from the base station. The transmission and receiving of data is done by the only node which is nearer node of its neighbors. Token is sharing through chain to leader from both side of the node. To find out the nearer neighbor, it uses signal strength which measures the distance from the neighbor. There is randomly selected a node (leader) from the chain and this node is responsible for sending aggregated data to the base station.
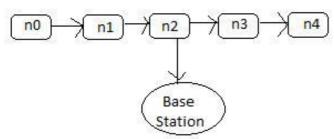
Fig -4 Chaining process in PEGASIS

4.3 SPIN (Sensor Protocols for Information via Negotiation):

SPIN is a data-centric routing protocol and also an element of adaptive protocols that practices data for negotiation and resource- adaptive protocols. The basic concept behind SPIN is that the data using high-level descriptor or meta-data. Here, it assumes that all the nodes are base station and all the information are advertised to each node in the network. So any user gets all the information rapidly by sending query to the node.
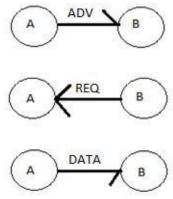
Fig -5 SPIN process

Before transmission, meta-data are exchange among all the nodes in the network and thus avoids transmission of redundant data. When the node receives the data, it broadcasts the data to its neighbor and if a neighbor is interested to get this data then it send request message to broadcast node. The meta-data are helpful in solving the problem of flooding and due to this it save energy in the network.

SPIN uses three types of messages for commuting with other nodes. The messages are ADV for advertizing new data, REQ for requesting data and DATA is an original message.

4.4 DD (Directed Diffusion)

Directed diffusion is a data-centric and application-aware protocol and the data is developed by sensor node called as attributed-value pairs. Here directed data includes four components: interests, data-messages, gradients and reinforcements. Interest is used for describe a task, data messages are used for the label of attribute value pairs, gradient is used to determine data rate as well as the direction of event and the reinforcement are used for choosing the particular path from a number of path. In this protocol, the query is diffuses towards nodes in the needed region and the query is diffused hop-by-hop in the network. All nodes in the network receives the interest and set-up gradient towards the nodes. This procedure is continuing until the gradient is setup from source to back station. The obtaining data are return back to the base station including with the reverse path.

Directed Diffusion protocols are application based and due to this it conserves energy by choosing the optimal paths by caching and processing data in the network.
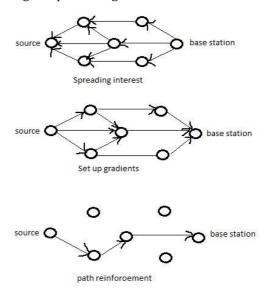
Fig -6 Directed Diffusion

5. CONCLUSION AND FUTURE SCOPE

Routing algorithms is the important part in conservation of energy in a wireless sensor network during transmission of data in a network. Sensor networks are constructed for performing some particular applications and for best result of the network it is need to design a energy efficient routing protocol. In this paper, we compare different routing algorithms by using the different parameters. For future perspective, there is need of focusing improvements in these routing algorithms to minimize the energy in a sensor network.

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