Review on Energy Efficient Algorithm in Wireless Sensor Network

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Abstract: - Wireless sensor network is a growing field. Energy resource is very restricted in wireless sensor network. Sensor network are used for several application. Sensor network still faces downside in delivering data from source to sink. Routing algorithm are developed for this data transmission from source to sink. Energy saving is the most significant issue related to wireless sensor networks. There are several algorithms introduced to date for reducing the energy consumption in wireless sensor network. In this paper numerous algorithm are mentioned to improve the lifespan of the network. Opportunistic routing algorithm plays an important role for energy saving. Moto of this paper is to provide an overview of reported energy efficient algorithms employed in wireless sensing element network.

Keywords:- Wireless sensor network, routing, opportunistic routing, energy efficiency.

Introduction

The wireless sensor network is nothing but assortment of tons of and thousands of little sensing element nodes. It has terribly wide range of application in our daily life such as traffic observance, medical treatment, agricultural related work etc. are few applications [1]. Routing algorithm is process of step by step operations. The task of routing embody route choice and packet forwarding once the packets leaves its source there are several methods through which it will reach its destination hence completely different routing algorithm employed in order to determine the simplest path packet will adapt. There are ranges of algorithm for reducing energy consumption in sensor network and from these algorithms some are well matched for finding the answer associated with energy consumption. But steps to design energy efficient algorithm in wireless sensor network is multifold, it is not solely concern about concerning minimum energy path from source to sink however balancing the residual energy of the whole network [2]. Wireless sensor network have several algorithm some of them are mentioned below.

Classification of routing algorithm

There are chiefly four divisions of routing algorithmic as follows-

1) Data centric

A first category of routing protocols uses a data-centric approach to disseminate interest among the network. The approach uses attribute based naming, whereby a source node queries an attribute for the phenomenon rather than an individual sensor node. The interest dissemination is achieved by assigning tasks to sensor nodes and expressing queries to relative to specific attributes [3]. Different strategies are often used to communicate interests

to the sensing element nodes, as well as broadcasting, attribute primarily based multicasting, geo casting, and any casting.

2) Hierarchical based

A second category of routing protocols imposes a structure on the network to achieve energy potency, stability, and measurability. During this category of protocols, network nodes organized in clusters during which a node with higher residual energy, for example, assumes the role of a cluster head. The cluster head is responsible for coordinative activities within the cluster and forwarding information between clusters. Clustering has potential to scale back energy consumption and extend the lifetime of the network.

3) Location based

A third category of routing protocols uses location to deal with a sensing node. Location-based routing is useful in applications wherever the position of the node among the geographical coverage of the network is relevant to the question issued by the source node. Such a question could specify a particular space wherever phenomenon of interest could occur or the section to a particular purpose within the network surroundings.

4) Opportunistic Routing

Opportunistic routing may be a new paradigm in routing for wireless sensor network that chooses the node nearest to the target node for forwarding the information. It uses the broadcasting nature of wireless sensor networks. Opportunistic routing has increased the efficiency throughput and reliability of sensor network. Several energy saving techniques has been introduced with the aid of opportunistic routing in wireless sensor networks for increasing the network lifespan. The most plan behind opportunistic Routing is select a set of the nodes between the source and also the destination node and the node nearest to the destination can initial attempt to convey packets. The two steps are-

- Choices of the forwarder sets: Selecting only the potential nodes between the source and destination to extend the routing potency.
- Prioritization among these forwarders: the very best priority forwarder ought to be the nearest one to the destination.

Let us discuss some necessary algorithms that facilitate in conservation of energy, improving network lifespan [4, 5].

Flooding and Gossiping

In flooding every node receiving data packet forwards to any or all neighbour nodes and this method is recurrent until the packet reaches to destination. The difficulty of data implosion happens during this method. To beat this drawback conservation is introduced. During this every node send the data packet to at least one or designated node in spite of causing the packet to any or all the nodes. Then the neighbour nodes follow constant methodology till packet reaches to destination.

Sensor Protocol for Information via Negotiation (SPIN)

This is a family of accommodative protocols that use data negotiation and resource-adaptive algorithms. SPIN could be a knowledge central routing protocol. It assumes:

- All nodes within the network area unit base stations.
- Nodes in shut proximity have similar knowledge.

The key plan behind SPIN is to call the data exploitation high-level descriptors or meta-data. Since all nodes will be assumed as base stations all data is broadcasted to every node within the network. Therefore user will question to any node and might get the data straightaway [6, 7]. Nodes during this network use a high level name to explain their collected knowledge referred to as meta-data.

Leach (Low-Energy Adaptive Clustering Hierarchy)

Low-energy adaptive clustering hierarchy could be a routing rule designed to gather and deliver knowledge to the data sink, generally a base station [8]. The most objectives of LEACH are-

- Extension of the network period of time.
- Reduced energy consumption by every network device node.
- Use of data aggregation to scale back quantity of communication messages.

To get on top of objectives, leach follows hierarchal approach to manage the network into a collection of cluster head. The cluster head has the responsibility to hold out totally different tasks. The essential operations of leach area unit organized in two distinct phases. The primary part, the setup part, consists of two steps, cluster head choice and cluster formation. The second part, the steady-state part, focuses on knowledge assortment, aggregation, and delivery to the base station.

Threshold-Sensitive Energy Efficient Routing Protocols (TEEN and APTEEN)

Two hierarchal routing protocols referred to as TEEN (Threshold-sensitive Energy efficient sensor Network protocol), and APTEEN (Adaptive Periodic Threshold Sensitive Energy Efficient sensor Network protocol) planned here. These protocols were planned for time-critical applications. In TEEN, device nodes sense the medium endlessly; however the data transmission is completed less of times [8]. A cluster head device sends its members a tough threshold, that is that the threshold value of the perceived sensed and a soft threshold that could be a small within the value of the sensed attribute that triggers the node to change on its transmitter and transmit. Therefore the exhausting threshold tries to scale back the quantity of transmissions by permitting the nodes to transmit only the sensed attribute is within the vary of interest. The soft threshold reduces the quantity of transmissions which may have otherwise occurred once there's very little or no amendment within the sensed attribute. A smaller value of the soft threshold provides a lot of correct image of the network, at the expense of multiplied energy consumption. Thus, the user will manage the trade-off between energy potency and data accuracy [9]. Once cluster heads area unit to alter, new values for the on top of parameters area unit broadcast. The most downside of this theme is that, if the thresholds don't seem to be received, the nodes cannot communicate and user does not get any data from the network.

Geographic Random Forwarding

Geographic Random Forwarding (GeRaF) could be a geographical forwarding protocol. It selects a forwarder set and prioritizes them by location information data. In GeRaF every packet carries the locations of the sender and destination. Solely those neighbouring nodes nearer to the destination than the sender will be forwarder candidates. Moreover, these eligible candidates rank themselves supported their geo distances to the destination [10]. During this method the forwarder set associated prioritization will simply be enforced via an RTS-CTS dialog at the MAC layer that conjointly ensures that one forwarder will be chosen. GeRaF adopts hop-by-hop forwarder set choice. It is targeted for comparatively dense networks. GeRaF is straightforward to implement. However, the value for effort location data could also be too high to implement, atleast nearer the close to future.

Exclusive Opportunistic Routing (ExOR)

This is the primary most simple protocol that much enforced the opportunist routing within the wireless networks. ExOR uses batches to send the packets. The source node collects the packets that area unit meant to the same destination and teams them into a batch. Every batch has its own Batch ID. The source node chooses the Batch ID and also the forwarder list prioritized, shorter the space of node from target node higher the priority. solely the nodes having higher priority area unit enclosed within the forwarder list. Every node within the forwarder list maintains an local batch map. The node adds the packet into the packet buffer for the corresponding batch. The node compares the entry for every batch map within the packet with corresponding entry within the native batch map and if the higher priority entry is detected it replaces the entry within the local batch map. ExOR implements scheduled transmission of packets to confirm that just one node sends the packet at just one occasion. ExOR achieves higher output than the normal routing however it's following drawbacks.

- ExOR does not answer the updated measurements. It solely considers the data offered at the time of transmission. So, the inaccurate measurements could degrade its performance and conjointly could cause packet duplication.
- It continuously seeks the coordination among all the nodes that causes overhead just in case of huge network. It does not reuse the information.

Energy Saving via Opportunistic routing (ENS-OR)

This paper primarily consideration regarding the energy savings idea within the WSNs. It describes the rule that focuses on minimizing the energy consumption of the network. The author proposes Energy Saving via Opportunistic Routing (ENS OR). The rule implements the idea of energy efficient node (EEN) that happens to be a virtual relay node obtained by relay operates on many real nodes supported their residual energy. The forwarder list choice and prioritizing the nodes within the list is administered by the ENS OR rule calculates the best hop distance to calculate consequent hop node to forward the data. The nodes within the forwarding list prioritise themselves by their residual energy and their distance from energy equivalent node. ENS-OR obtains higher network energy usage. Conjointly it will increase the network period of time by achieving higher residual energy of the nodes within the network. The packet delivery rate of ENS-OR is larger than that of GeRaF.

Advantages of ENS-OR

The various blessings of energy saving via opportunist routing rule area unit as follows-

- Predefined set of relay nodes are placed at regular intervals within the network in order that any node will transmit to relay node then the info will reach the sink.
- Transmission range is adjusted dynamically supported the residual energy for the nodes within the network.

Comparative Study

Comparison of above mentioned algorithms with their performance depending on different parameters.

Algorithm	Power management	Network Lifetime	Routing Technique	Residual Energy
LEACH	Maximum	Very good	Hierarchical	Low
TEEN & APTEEN	Maximum	Very good	Hierarchical	Medium
SPIN	Limited	Good	Data Centric	Low
GeRaF	Limited	Good	OR	Medium
Ex-OR	Maximum	Good	OR	Low
ENS-OR	Maximum	Excellent	OR	High

Conclusion

Routing in wireless sensor network is becoming new area of research. In this paper overall routing methods are divided into four categories-data centric, hierarchical, location, opportunistic. The primary goal of WSN routing algorithm is to save energy and extend network life cycle. There are many algorithms which help in reducing the energy consumption in wireless sensor network. Such algorithms were discussed here briefly.
Future perspectives of this work is focussed on making changes in one of the routing algorithm which is discussed in this paper such that modified algorithm could minimise more energy for the entire system.

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