Review of Transmission Strategy of Wireless Sensor Network for Lifetime Maximization

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Abstract- The data transmission process in WSN consumes large amount of energy for long distance. Energy efficiency is the key concern in WSN communication. Sensor nodes are battery operated and hence requires more energy. So, Researchers have developed protocols and transmission strategies to conserve the energy in WSN. In this paper, we are going to see review of single hop, multi hop and hybrid communication and its types. These are energy efficient protocols which help in conserving energy during transmission.

Index Terms- Single hop, Multi hop, Hybrid.

1. INTRODUCTION

The researchers in communication area have attracted by WSN because of its capacity of providing large number of applications. Area monitoring, Health care, Environmental monitoring, industrial applications, etc. are the application areas of WSN.

The lifetime of WSN has most important issue. The energy and distance should be taken into the consideration to extend the lifetime of WSN with less energy consumption and less distance.

In WSN, Each time the data packet is passed to the next router, a "hop" occurs. If there is only one hop between source station and destined host then it is considered as single hop and if more than one hop are there, then they transfer data from one hop to the next from source station to destined host. In this case it is called as multi hop communication.

Single-hop networks are used in many communication systems. The first reason for that, there is no need of routing assumptions and overload traffic for routing support. Delay is less and negligible. Another advantage is synchronization of time is simpler. Much research has been done on single hop energy consumption. Reduction in use of energy of the processing unit is required. In case of WSN, use of power of energy is less because energy spent on decoding the transmitted signal at the receiving end. Some situation arises where single hop cannot be used for transmitting data between transmitter and receiver. At that time multi-hop communication can be implemented. This type of hoping deals with several relay nodes. These relay nodes helps to transmit data from sink to destination node. The transmission process requires energy. As we have seen earlier, these hop which consumes energy and distance between the relay node and key concern in consumption of energy. Hybrid communication is the combination of single hop and multi hop communication. There are wide number of research and studies on single hop or multi hop optimum distance estimation and derivation which showing the relation between energy consumption and
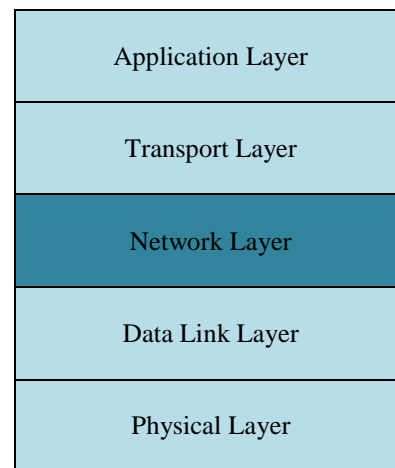

Fig. 1. Network Layer shown in protocol stack model

number of hop.

2. HOP TECHNIQUES

In WSN, single hop and multi hop communication is used to route data from source to the sink. The sink communicates with sensor nodes by using internet or satellite. Figure 1 shows the protocol stack with five layers and it used for sink and the sensor nodes. Among five layers, we are taking network layer into consideration. This layer provides all kind of routing services. The main function of this layer is to use less energy while transmitting the data. While using single hop and multi hop communication, the data routing is done in energy efficient manner with less delay. This is done with hop of developed routing protocols. And hence network lifetime gets increased.

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2.1. *Single hop*

If there is only one hop between source station and destined host that means wireless stations are connected to wireless access points which connects to router via a wired network, then it is known as single-hop network. It has three types, i.e., 802.11, 802.16 and Cellular networks. [1], [2]

2.1.1. *802.11*

The IEEE 802.11 network with large propagation delays shows some properties which render the known analytic approximation inapplicable. This lead to channel idleness misaligned by nodes and short term unfairness errors sensing in access to the medium. Due to this, the stateless, constant attempt rate approach adopted but it doesn't work.

2.1.2. *802.16*

IEEE 802.16 technology has been developed for the next-generation high-speed wireless communication system. It is also expected to provide Quality of Services (QoS). In a typical IEEE 802.16 network, wired link is present between the base station and wired network. Traffic received by base station from the external network through wired link. This traffic get distributes to corresponding sector and then destination subscriber station receives downlink traffic. In case of uplink direction, source subscriber stations delivers uplink traffic to base station and then base station sends it to the external wired network. This is also done via wired link.

2.1.3. *Cellular Network*

In cellular network, one base station and multiple mobile stations are there. The base station controls each cell, so called as Centralized Controller. The base station transmits data packets and signaling messages to mobile or subscriber stations through single hop wireless link and vice versa. The single hop wireless link transmits and receives data directly without any intermediate.

2.2. *Multi hop*

The wireless network in which communication between two ends is take place through number of intermediate nodes who relays the information from one point to another, is called as multi hop network. Multi hop energy efficient protocols are classified as: Chain based routing and Heterogeneity based routing.
The name Multi hop energy efficient protocols is given due to its function. This type of routing protocols mainly used to minimize travelling paths among the node and so that use less energy. Hence, it

is maximizing the life of the WSN. Figure 2 shows classification of multi hop routing protocol. [3], [4]
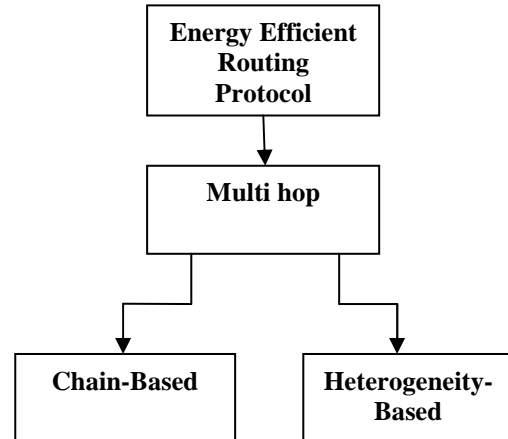

Fig. 2. Classification of energy efficient routing protocol

2.2.1 *Chain-Based Data Transmission*

For the concept of chain-based transmission, multipath and free-space models are used. Cluster near the base station are smaller with compared to the cluster away from it. To avoid problem of the hot spot near the base station due to data forwarding, this strategy is used. Competition radius of the node should be less to avoid the predefinition. Each cluster head (CH) contains adjacent tentative CHs list. CH selection should take place. After that, each node tries to join the closest cluster with large amount of received signal strength. The intra cluster routing deals with election of optimal number of clusters and the CH get rotated among the nodes. In case of inter cluster communication, the distance of the nodes from base station is measured. If distance is less than threshold distance, then data can be transmitted directly and if distance is more, then a forwarding node is used to forward data. High residual energy node is chosen as forwarding node. [6]

2.2.2 *Heterogeneity-Based Protocol*

Some application sensors have different capabilities in communication, storage, power, sensing and processing are known as Heterogeneous Sensors. Some powerful nodes are used here for in-network processing and inexpensive nodes are used for sensing. These nodes are able to extend the network lifetime. Some sensors required high quality links. These links reduces number of hops between sink and source. These links are called as back-haul links. If the distance of sensor is one hop from sink or back haul

sensor, then end-to-end success rate is same as link success rate. And hence link heterogeneity can maintain lifetime of network. [6]

2.3. *Hybrid*

The hybrid technique merges the direct single hop and multi hop wireless relays. This network takes advantages of both single hop and multi hop networks into account. The benefits of hybrid networks provide efficient centralized wireless network control and flexibility. Hybrid network utilizes benefits of single hop and multi hop relay architecture. It extended network coverage area at the boundary of cell. Improvement of received signal quality and load balancing are the major advantages of hybrid network. Use of hybrid network helps to reduce the energy consumption. [5]

Hybrid network includes a base station, some relay stations and mobile stations. At some nodes single hop operation takes place as data packets are sent directly from source to sink. But in some operations, i.e., in multi hop operations data packets are sent via intermediate nodes or we can say via relay nodes. This has replaced one-to-many access mode by many-to-many access mode which opens up new connections and transmission links. Local communication reduces the network traffic, noise and interference among devices. This improves the radio bandwidth sharing. The communication type is local, that means the signal transmission distance is short. The short distance required less power. These benefits compensate the need of amount of energy. [7]

3. OTHER ADVANCED ROUTING PROTOCOLS

There are large number of protocols have been proposed in past that are energy efficient. Still the research is continuously going on. Some researchers are working on energy aware protocols too. The EAACA is one of them. EAACA is Energy Aware Ant Colony Algorithm. [8] It can be used to select the closest path from the source node to sink node for fast communication with limited use of energy in WSN. In case off EAACA routing protocol shifts to the next hop, then distance to the sink node is taken into account. During this process, residual energy of next hop and average energy of the path is considered. By balancing energy consumption of the nodes in WSN, the network lifetime get increased.

4. CONCLUSION

In this paper, we have studied different types of energy efficient routing protocols and it subtypes. As we discussed, data can be transmitted from source node to the sink node via single hop, multi hop or hybrid communication. Single hop can be used for shorter distances. For long distance communication,

energy consumption is more for data transmission and sensing as the distance has increased. Thus, there is requirement of reduction in energy consumption and extension of network lifetime. For this purpose multi hop and hybrid communications are used. This occupies large coverage area with reduced transmission power of the sensor nodes. But the relay node depletes its energy earlier than other nodes. This create problem in WSN communication. Many other technologies have been developed by researchers in which relay node error cannot be encountered. As an example, we saw EAACA routing protocol. It uses ant colony optimization and ants are used instead of relay nodes.

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