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A BRIEF STUDY ON ROUTING PROTOCOLS IN WIRELESS SENSOR NETWORKS

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1. ABSTRACT

In wireless sensor networks, the nodes find the route towards the sink node to transmit the data to the base station. The sensor node transmits the gathered information directly to the sink node, or it relays the information through neighbor nodes. There are various protocols used in routing and in different aspects of wireless sensor networks. This paper presents a review study on some of the routing protocols used in wireless sensor networks. Additionally, the paper includes various protocols used for various purposes.

2. INTRODUCTION

Wireless sensor networks consists of highly distributed small and light weight nodes which monitors the environment al conditions like temperature, sound , vibration, pressure, pollutants and to pass the collected data to their base station. Wireless sensor networks have many uses now a day these networks are used in machine monitoring health, industrial and consumer applications. A wireless sensor network is a built of nodes from a few to thousands and every node is connected to a sensor. A wireless sensor node consists of computing, communication, sensing, power components and actuation.

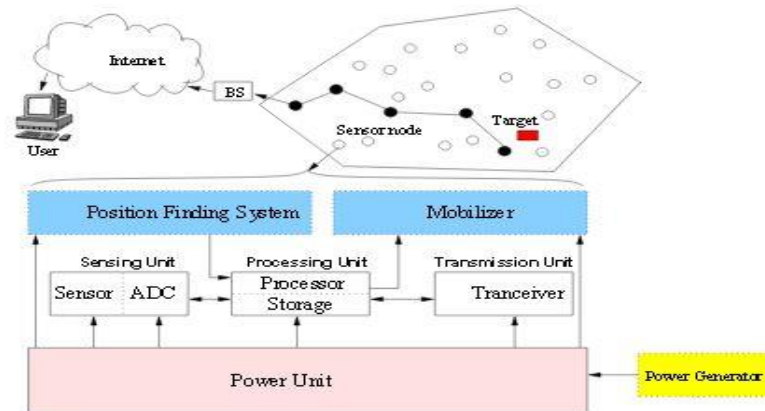


Fig: Sensor node structure

For sending and receiving data from one node to another we need to follow some instructions or protocols. There are various routing protocols proposed so far. Some of them are discussed in this paper.

3. CLASSIFICATION OF ROUTING PROTOCOLS

Routing protocols are classified using some parameters:

- 1) Based on type of target applications and mode of functioning
- 2) Based on the network structure
- 3) Based on participation styles of the nodes

3.1 BASED ON TYPE OF TARGET APPLICATIONS AND MODE OF FUNCTIONING:

3.1.1 Proactive routing protocols:

In this type of protocol, all paths between source and sink nodes are regularly computed and stored in a routing table. The nodes switch on their sensing devices and transmitters. They sense the environmental or surrounding conditions and transmit data to a base station through a predefined route.

E.g. the low energy adaptive clustering hierarchy protocol (LEACH) uses this protocol.

3.1.2 Reactive routing protocols:

When a particular node wants to send the data it acquires the path on demand and no path to destination is known in prior. Whenever the sink node wants to contact a particular node the path values are calculated and the best path is chosen for data transmission.

E.g. threshold sensitive energy efficient sensor network (TEEN)

3.1.3 Hybrid routing protocols:

This type of protocols possesses both the features of proactive and reactive concepts. The network is divided into some regions or zones. If data is to transmit within the zone then uses the proactive routing protocols and if we need to transmit the data to a node of another region then reactive routing protocols are used.

E.g. Zone routing protocol and dynamic zone topology routing protocol.

3.2 BASED ON PARTICIPATION STYLE OF NODES:

3.2.1 Direct Communication:

In this case any node in the network can transmit the data directly to the base station. When this is implemented to a large network the battery power may drain very quickly. This type of protocols is used for only small networks.

E.g. Sensor protocol for information via negotiation.

3.2.2 Flat routing protocols:

All the sensor nodes which are participating in routing play the same role of gathering data and transmitting to the sink node. Nodes near to the base station may drain their energy quickly.

E.g. Rumor routing

3.2.3 Clustering protocols:

In this type of protocols, the total area is divided into number of clusters. Every cluster has a cluster head and this cluster head communicates directly with the base station. All the other nodes send the data to the cluster head.

E.g. Threshold sensitive energy efficient sensor network

3.3 BASED ON NETWORK STRUCTURE:

The goal of hierarchical routing protocols is to perform energy efficient routing in wireless sensor networks and also to avoid overload of sink nodes. Higher energy nodes can be used to process and transmit the data. Low energy nodes are used to collect the data.

E.g. Low energy adaptive clustering hierarchy (LEACH)

3.3.1 Data centric:

Data centric protocols are query based. Destination node sends queries requesting for the data from the nodes in the network, if a sensor node has the data that match the query, it sends them back to the requested node.

E.g. direct diffusion and sensor protocols for information via negotiation.

3.3.2 Location based routing protocols:

In this type the protocols need some location information. Location information can be obtained using GPS signals or radio signals. In some location based schemes in order to save energy, the sensor nodes change their mode to sleep if there is no activity.

E.g. Geographical and Energy-Aware routing (GEAR)

4. OTHER PROTOCOLS USED IN WSN

4.1 DATA DISSEMINATION PROTOCOLS:

The data gathered by the nodes has to be communicated to any other node interested in the data or to the base station. The sensor node that generates the data is known as source and the information to be sent is called an event. A sensor node which is interested in an event and seeks information about it is known as a sink node. Different traffic models have been developed for wireless sensor networks such as data collection and data dissemination models. Some of them are discussed below.

4.1.1 Drip:

Drip is the dissemination protocol and it is used in sensor network management system (SNMS). Drip is the simplest protocol in data dissemination and it is based on trickle algorithm and generates an individual trickle for each variable in the data.

4.1.2 Code Drip:

Code Drip protocol is one of the data dissemination protocols and mainly used for dissemination of small values. It uses network coding to improve reliability, and speed of data dissemination.

4.1.3 Dip:

Dip is the data detection and dissemination protocol based on trickle algorithm and it works in two parts: detecting if difference of data in nodes occurred, and identifying the data item which is different.

4.2 DATA GATHERING PROTOCOLS:

The main objective of the data gathering protocols is to transmit the gathered data to a base station. Some of the algorithms that implement the data gathering are:

4.2.1 Direct Transmission:

All the sensor nodes in the network can directly send the data to the base station. It is expensive in terms of energy consumed and the life of battery diminishes very quickly.

4.2.2 PEGASIS:

PEGASIS is a data collecting protocol based on the assumption that the topology information is available to all other nodes in the network.

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