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REVIEW OF ROUTING PROTOCOLS IN SENSOR AND ADHOC NETWORKS

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ABSTRACT

The use of wireless sensor networks (WSNs) has foreseen huge changes in data gathering, processing, and dissemination for various environments and specific applications. In current developments, the use of simulations for networks offers a feasible way to deign and improve routing protocols. Grouping sensor nodes into clusters has been used widely in order to achieve the network scalability objectives. Every cluster would have a leader, often referred to as the cluster-head. Although many clustering algorithms have been proposed in the literature for Wireless Networks, the objective was mainly to generate stable clusters in environments with mobile nodes. This paper, gives a review work done on existing protocols in wireless sensor and adhoc networks.

Keywords: *Adhoc network, sensor network, clusters.routing protocols.*

1. INTRODUCTION

Recent advances in miniaturization and low-power design have led to the development of small-sized battery-operated sensors that are capable of detecting ambient conditions such as temperature and sound[1,2,13]. Sensors are generally equipped with data processing and communication capabilities. The sensing circuitry measures parameters from the environment surrounding the sensor and transforms them into an electric signal[4]. Processing such a signal reveals some properties about objects located and/or events happening in the vicinity of the sensor.

2. CHALLENGES OF SENSOR NETWORK

Routing in sensor networks is very challenging due to several characteristics that distinguish them from contemporary communication and wireless ad-hoc networks[1,2,5,6].

- It is not possible to build global addressing scheme for the deployment of sheer number of sensor nodes. Thus classical Internet Protocol based routing protocols can not be applied to sensor networks.
- In contrary to typical communication networks almost all applications of sensor networks require the flow of sensed data from multiple regions (sources) to a particular sink.
- Generated traffic has significant redundancy in it since multiple sensors may generate same data within the vicinity of a phenomenon. Such redundancy needs to be exploited by the routing protocol to improve energy and bandwidth utilization.
- Sensor nodes are tightly constrained in terms of transmission power, on-board energy, processing capacity and storage and thus require careful resource management.

3. CLASSIFICATION OF SENSOR ROUTING PROTOCOLS

The classification of Routing protocols for sensor network are based on a.protocol operations b.Network Structure.

A. PROTOCOL OPERATION

The protocol by operation are given below

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3.1 Negotiation based routing

These protocols use high-level data descriptors called "meta-data" in order to eliminate redundant data transmission through negotiations. The necessary decisions are based on available resources and local interactions.

3.2 Multipath based routing

These protocols for fault tolerance by having at least one alternate path(from source to sink)and thus,increasing energy consumption and traffic generation.These paths are kept alive by sending periodic messages.And its features given below

A.Maximum Lifetime Routing in Wireless Sensor Networks

Features

It is a protocol that routes data through a path whose nodes have the larges residual energy.

The path is switched whenever a better path is discovered. The primary path will be used until its energy is below the energy of the backup path. By means of this approach, the nodes in the primary path will not deplete their energy resources through continual use of the same route,thus achieving longer lifetime.

A disadvantage for applications that require mobility on the node, is that the protocol is oriented to solve routing problem in static wireless networks.

B. HIERARCHICAL POWER-AWRE ROUTING IN SENSOR NETWORKS:

Features

The protocol enhances the reliability of WSNs by using multipath routing.

It is useful for delivering data in unreliable environments. The idea is to define many paths from source to sink and send through them the same subpackets. This implies that the traffic will increase significantly but increasing the reliability of the network.

The idea is to split the original data packet into subpackets through each path. This can offer at the end, even with the loss of subpackets,the reconstruction of the original message.

3.1.3Query based routing

In these protocols, the destination nodes propagate a query for data (sensing task or interest) from the node through the network. The node(s) containing this data send it back to the node that has initiated the query.This consists following types

Features

It is a protocol used in the context of event notification.

The approach does not flood the network with information about an event occurrences but only installs few paths in the network by sending out one or several agents. The agents propagate through the network installing routing information about the evevnt in each node that is visited.

Rumor routing performs well only when the number of events is small.

3.1.4 Location based routing

In the protocols, the nodes are addressed by their location. Distances to next neighboring nodes can be estimated by signaling strengths or by GPS receivers. And is following type

A. Geographic Adaptive Fidelity (GAF)

Features

This protocol is energy-aware location-based routing designed primarily for mobile ad hoc networks and can be apoplicable to sensoer networks as well.

GAF keeps energy by turning off necessary nodes in the network without affecting the level of routing fidelity.

There are three states defined in GAF

These states are

1. Discovery: for determining the neighbors in the grid
2. Active: reflecting participation in routing.
3. Sleep: when the radio is turned off.

B. Geographic and Energy Aware Routing(GEAR)

Features

The protocols uses geographic information while disseminating the queries to the areas of interest since data queries often includes geographic attributes.

The protocol uses energy aware and geographically informed neighbor selection to route a packet towards the target area.

3.2 Network structure

3.2.1Flat based routing

In these protocols,all nodes have assigned equal roles in the network.

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A. Sequential Assignment Routing(SAR)

Features
It uses multipath approach and path restoration.
The objective of SAR algorithm is to minimize the average weighted QoS metric throughout the lifetime of the network.

B. Directed Diffusion

Features
It uses data-centric paradigm and is application-aware.Since it is data centric,all communication is neighbor-to-neighbor with no need for a node addressing mechanism.
The protocol eliminates redundancy of data and minimizes the number of transmissions;thus saving energy and prolonging network lifetime.
It aims at dealing with scalability issueas.

C. Data-centric Data Dissemination(D3)

This protocol combines the advantages of data-centric routing like SPIN and DD with energy efficient MAC protocols.The main advantages are its energy efficiency and simplicity[5],D3 can easily handle energy-dependent traffic balancuing and data aggregation.

D. Gradient-Based Routing(GBR)[3]

It is a slightly changed version of Directed diffusion. The idea is to keep the number of hops when the interest is diffused through the network. On the other hand,three different data spreading techniques have been presented
Stochastic Scheme: when there are two or more next hops with the same gradient, the node chooses one of them at random.
Energy-based scheme: when a node's energy drops below a certain threshold, it increases its height so that sensors are discouraged from sending data to that node.
Stream-based scheme: the idea is to divert new streams away from nodes that are currently part of the path of other streams.

E. Constrained Anisotropic Diffusion outing(CADR)

Features
Each node evaluates an information/cost objective and routes data based on the local information/cost gradient and end-user requirements.
It diffuses queries by using a set of information criteria to select which sensors to get the data.
It is more energy effuicient than DD.
IDSQ can be seen as a complementary optimization procedure for the protocol.

F. Active Query forwarding In sensor networks (ACQUIRE)

Features
This protocol is a data-centric mechanism for querying sensor networks.
The protocol considers the sensor network as a distributed database.

G. Minimum Cost Forwarding Algorithm(MCFA)

Features
Each sensor node must know the least cost path that goes from itself to the sink. Each node maintains the least cost estimate from itself to the sink.
Each message to be forwarded by the node is broadcasted to its neighbors.

H. Energy Aware Routing(EAR([3]

Features
It is a reactive protocol used to increase the lifetime of the network.
This protocol creates routing tables about the paths according to the costs.

3.2.2 Hierarchical based routing

Also known as cluster-based routing,in these protocols,the nodes can play different roles in the network and normally the protocol includes the creation of clusters. Clustering algorithms in the literature varies in their objectives. Often the clustering objective is set in order to facilitate meeting the applications requirements. For example if the application is sensitive to data latency, intra and inter-cluster connectivity and the length of the data routing paths are usually considered as criteria for Cluster Head selection and node grouping clustering.[7,8,9,10,11,12].Additionally,designation s of tasks for the sensor nodes with different characterstics are also performed.

A. Low Energy Adaptive Clustering Hierarchy(LEACH)

Features
It is a cluster-based protocol with distributed cluster information. The algorithm randomly selects cluster

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heads and rotates the role to distribute the consumption of energy.
LEACH uses TDMA?CDMAMAC to reduce inter-cluster and intra-cluster collisions and data collection is centralized with defined periods

B. Power-Efficient Gathering in sensor Information Systems(PEGASIS)

Features
This protocol is an enhancement over LEACH protocol.
The main idea of the protocol is that in order to extend network lifetime,the nodes need only to communicate with their closest neighbor and they take turns in communicating towards the base stations.

C. Adaptive Periodic Threshold-sensitive Energy Efficient sensor Network protocol(APTEEN)

Features:
It is a hybrid protocol proposed for time-critical applications. The sensor nodes sense the medium continuously,but the data transmission is done less frequently.
The protocol defines cluster heads to control the transmission of messages.
It uses a TDMA schedule and each node in the cluster is assigned a transmission slot.
Performs better than LEACH.

D. Minium Energy Communication Network(MECN)[3]

Features
it sets up and maintains a minimum energy network for wireless networksby utilizing low power GPS.
MECN is self-reconfiguring and thus can dynamically adapt to node's failure or the deployment of new sensors.

E. Small Minimum Energy Communication Network(SMECN)

Features
It is a protocol that computes an energy efficient subnetwork(clusters).
The protocol is self-reconfiguring and thus can dynamically adapt to node failure.SMECNuses less energy than MECN and maintenance cost of the links is less.

F. Virtual Grid Architecture (VGA)

Features
it is based on the concept of data aggregation and in network processing.
This routing paradigm considers an extremely low mobility of sensor nodes. Therefore, this protocol arranges the nodes in a fixed topology forming clusters that are fixed.

3.2.3. Adaptive based routing
In these protocols, the system parameters are controlled to be adapted to the actual network conditions by means of acquired information of the network and negotiation between nodes.

Sensor protocols for information via Negotiation (SPIN)

Features
The protocols disseminate all the information at each node to every node in the network assuming that all nodes in network are potential base-stations. With this, the user can query any node and get the needed information immediately.
The protocols use data negotiations and resource adaptive algorithms.
These protocols distribute the information all over the network, even when the user does not request any data.

4. AD-HOC NETWORKS AND ROUTING

A collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized network is called an ad-hoc network. The main characteristic of an ad-hoc network is the topology which changes very much dynamically. Routing has been always major problem in networks for sending data from one node to another. And the problem is even more in case of ad-hoc networks. Several ad-hoc network routing protocol have been proposed.

Ad-hoc Routing Protocols:
There are different ways for designing and categorizing routing protocols for wireless ad-hoc networks. Foe example what routing information is exchanged? When and how the routing information is exchanged?

Proactive Routing: In proactive routing schemes routes are established among various nodes in the network in advance so that the route is already

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present whenever needed. Route discovery overhead are large in such schemes.

Reactive Routing: In reactive routing schemes routes are determined whenever needed. Therefore they have smaller Route Discovery overheads.

Table Driven: In table driven routing protocols up-to-date routing information from each node to every other node in the network is maintained on each node of the network. The changes in the network topology are propagated in the entire network by means of updates.

Source Initiated: Routes are established when desired by the source node. When a node requires a route to a certain destination it initiates a route discovery process.

5. APPLICATIONS

Each sensor has an onboard radio that can be used to send the collected data to interested parties. Such technological development has encouraged practitioners to envision aggregating the limited capabilities of the individual sensors in a large scale network that can operate unattended. Numerous civil and military applications can be leveraged by networked sensors. A network of sensors can be employed to gather meteorological variables such as temperature and pressure. These measurements can be then used in preparing forecasts or detecting harsh natural phenomena. In disaster management situations such as earthquakes, sensor networks can be used to selectively map the affected regions directing emergency response units to survivors [1,2,14,15]. In military situations, sensor networks can be used in surveillance missions and can be used to detect moving targets, chemical gases, or the presence of micro-agents.

One of the advantages of wireless sensor networks is their ability to operate unattended in harsh environments in which contemporary human-in-the-loop monitoring schemes are risky, inefficient and sometimes infeasible. Therefore sensors are expected to be deployed randomly in the area of interest by a relatively uncontrolled means e.g. dropped by a helicopter, and to collectively form a network in an ad-hoc manner. Given the vast area to be covered, the short lifespan of the battery-operated sensors and the possibility of having damaged nodes during deployment, large population of sensors are expected in most Wireless Sensor Networks applications. It is envisioned that hundreds or even thousands of sensor nodes will be involved. Designing and operating such large size network would require scalable architectural and management strategies. In addition, sensors in such environments are energy constrained and their batteries can not be recharged. Therefore, designing energy aware algorithms becomes an important factor for extending the lifetime of sensors. Other application centric design objectives, e.g. high fidelity target detection and classification are also considered.

6. CONCLUSION

The paper begins with a brief introduction in Wireless Sensor Networks. we reviewed and studied the features of different protocols used in wireless sensor network then we are discussed the in Wireless Sensor networking. Finally, the characteristics of the protocols were discussed.

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