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A SURVEY ON ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORK

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Abstract

In wireless sensor network, devices or nodes are generally battery powered devices. These nodes have limited amount of initial energy that are consumed at different rates, depending on the power level. The lifetime of the network is defined as the time until the first node fails (or runs out of battery). In this paper different type of energy efficient routing algorithms are discussed and approach of these algorithms is to maximize the minimum lifetime of wireless sensor network. Special attention has been devoted for algorithms formulate the routing problem as a linear programming problem, which uses the optimal flow path for data transmission and gives the optimum results. Advantages, limitations and algorithms are also discussed in this paper.

Keywords:*AODV, MANETs, Protocol,DSR.*

1.Introduction

A sensor network is a network which consist of larger number of sensor nodes which are distributed in close proximity and purpose of these sensor nodes is to collect the data and give the information to the base station. As the location of individual nodes are not predetermined the network should have a capability of self –organizing and nodes will cooperate with each other for sending the information.

A large-scale ad-hoc network is being organized by the sensor node deployed in a network. A sensor node is having a limited amount of energy which is not noticed by different exiting protocol. The duration of the sensing task should be maximized by the use of optimal routing. On the basis of Energy histogram, we derive a practical guideline and for the enhancement of routing in sensor network a spectrum of new technique is developed. Our first approach aggregates packet streams in a robust way which results in a reduction of energy by a factor of 2 to 3. Secondly, by shaping the flow of traffic more uniform resource utilization can be obtained. The work shows that the network lifetime can be increased up to 80 to 90 percent by the use of different technique which rely only on localized metrics.

Different energy-efficient routing methods are proposed for a static wireless sensors network consisting of a large number of energy-constrained sensors and a few hubs as the cluster heads of sensors. On adopting a clustered traffic topology, with additionally deployed router sensors, an energy efficient routing design can be achieved to increase the sensor lifetime with the trade-off increased Consumption of energy at the entire network level. Simulations shows that using dense deployment of routers is capable of achieving the energy minimal routing design and the overall energy consumption can be even lower than without the routers **[1,2].**

Wireless sensor networks (WSN) consist of hundreds of small and low cost nodes with very limited energy, computing power and communication capabilities.These issues are considered in the design of Scalable Energy-efficient Location Aided Routing (SELAR) protocol for WSN. In SELAR, location and energy information of neighbouring nodes together with the location information of the sink node are used to perform the routing function. Simulations shows that SELAR performs considerably better than flooding in terms of network lifetime, energy distribution, and amount of data delivered **[3].**The network lifetime for wireless sensor network plays an important role to survivability; thus, indicate the importance of routing protocol to network lifetime, and model the expected retransmission time as a convex function with respect to aggregate jlow on each sensor node. Thus formulate the optimal energy-efficient routing as a non-linear min-max programming problem with convex product form, which can be optimally solved by optimal routing framework. Based on the optimal routing framework, propose Lagrangean based algorithm and primal optimal algorithm. By the combination of these two algorithms, one can optimally and efficiently get the routing assignment to maximize the network life in the sensor network. While the shortest path-based heuristic algorithm can only achieve about 48% network lifetime compared to this routing approach **[4].** Because sensors have limited battery power, energy-efficient routing is important. Hayoung Oh present a new sensor routing scheme that provides energy-efficient data delivery from sensors to the home base station. The proposed scheme divides the home area into sectors and locates a manager node to each sector. The manager node receives collected data from sensors and delivers the data to the base station through the shortest path of the 2-dimensional (x, y) coordinates. Performance results show that the proposed scheme reduces energy consumption significantly compared with conventional sensor routing schemes **[5].**

1.2 Energy-Efficient Sensor Routing

A sensor routing scheme, EESR (Energy-Efficient Sensor Routing) is presented which provides energy-efficient data delivery from sensors to the BS. This scheme divides the area into sectors and locates a manager node to each sector. The manager node receives collected data from sensor devices in its corresponding sector and then transfers the data to the base station through the shortest path of the 2-dimensional (x, y) coordinates. In the process, use of relative direction based routing in the 2-dimensional (x, y) coordinates in wireless sensor networks. Via analysis and simulation, the proposed scheme achieve significant energy savings and outperform idealized transitional schemes (e.g., broadcasting, directed diffusion, clustering**) [6].** The parameter □□E is used to evaluate the energy efficiency, and the theoretical analysis has been performed, By comparison results through NS-2 simulator, it has been verified that EBRI-MAC can win better energy-efficiency than IEEE802.11 DCF and S-MAC under the traffic pattern of each node being time-correlated **[7**]. An energy efficient spanning tree (EESR) based multi-hop routing in a homogeneous network maximizes the network lifetime. Given the location of the sensor nodes and BS. EESR generates a sequence of routing paths with appropriate number of rounds that maximize the lifetime of the system. Simulation experiment shows that proposed technique outperforms previous methods to maximize network lifetime **[8].** Proposal of routing scheme which significantly improves the performance of existing schemes such as LEACH and LEACH-C. The proposed scheme selects the cluster head not randomly but considering the remaining energy when the energy level drops below 50% of the initial energy. For each node, the cluster head to join is determined by not only the signal power but also by the remaining energy of the cluster head,and the data transmission occurs when the context satisfies the preset condition. Simulation through NS-2 shows that the proposed scheme outperforms LEACH and LEACH-C by 37% and 30%, respectively, in terms of the lifetime **[9].**

2.ENERGY EFFICIENT ROUTING ALGORITHMS

A key challenge in ad hoc wireless sensor network is achieving a long lifetime of nodes that carry limited amount of battery energy. It could be impossible or inconvenient to recharge the battery in the remote location therefore, the crucial requirement is to prolong the network life time.

2.1Need to Prolong the WSN Lifetime

• Devices are generally battery powered.

• Devices may be embedded inside structures.

• Failure of some devices may result in the failure of entire network.

• Sensor nodes cooperatively perform a single task so they must be alive for same amount of time.

• Sensor nodes are use for application where they monitor particular region so they must go down in a fashion that the overall task may be accomplish In wireless sensor networks the main objective is to maximize the minimum lifetime of each node. Lifetime is maximized by balancing the energy consumption of each node, using energy efficient routing. To maximize the objective function, it is appropriate for an emergency network in which every node is critical**[10].**

2.2 Assumption for energy efficient RoutingAlgorithms

• Consider a directed graph G (N, A) where N is the set of all nodes and A is the set of all directed links (i, j) where i,j Є N.

• Let Si be the set of nodes that can be reached by node i with a certain power level in its dynamic range, where link (i,j)exists, if j Є Si.

• A set of origin nodes O where the information is generated.

• A set of destination nodes D among which node can be reached in order for the information transfer be considered done.

• Let each node i have the initial battery energy Ei

• Let Qi be the rate at which information is generated at node i.

• The transmission energy required for node i to transmit a bit to its neighbouring node j is eij,

• The rate at which information transmitted from node i to node j is cSo based on the above [2] Assumptions, various energy efficient routing algorithms maximize the lifetime of network. These routing algorithms are alled the flow qij**[11].**

3. Ad Hoc NETWORK ROUTING PROTOCOL

An ad-hoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad hoc network . In ad-hoc networks, nodes are not familiar with the topology of their networks. Instead, they have to discover it. The explanations of Ad Hoc Network routing protocols is as follows:

3.1 Table-Driven (Pro-Active) Routing

This type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network. The main disadvantages of such algorithms are:

1. Respective amount of data for maintenance.

2. Slow reaction on restructuring and failures.

3.2 Reactive (on-demand) routing

This type of protocols finds a route on demand by flooding the network with Route Request packets. The main disadvantages of such algorithms are**:[12]**

1. High latency time in route finding.

2. Excessive flooding can lead to network clogging.

3.3 Flow Oriented Routing

This type of protocols finds a route on demand by following present flows. One option is to unicast consecutively when forwarding data while promoting a new link. The main disadvantages of such algorithms are:

1. Takes long time when exploring new routes without a prior knowledge.

2. May refer to entitative existing traffic to compensate for missing knowledge on routes.

3.4 Hybrid (both pro-active and reactive) Routing

This type of protocols combines the advantages of proactive and of reactive routing. The main disadvantages of such algorithms are**:[13]**

1. Advantage depends on number of Math van nodes activated.

2. Reaction to traffic demand depends on gradient of traffic volume.

3.5 Hierarchical Routing Protocol

With this type of protocols the choice of proactive and of reactive routing depends on the hierarchic level where a node resides. The main disadvantages of such algorithms are:

1. Advantage depends on depth of nesting and addressing scheme.

2. Reaction to traffic demand depends on meshing parameters.

3.6 Backpressure Routing

This type of routing does not pre-compute paths. It chooses next-hops dynamically as a packet is in progress toward its destination. These decisions are based on congestion gradients of neighbor nodes.

3.7 Host specific Routing Protocol

This type of protocols requires thorough administration to tailor the routing to a certain network layout and a distinct flow strategy. The main disadvantages of such algorithms are:

1. Advantage depends on quality of administration addressing scheme**[14].**

2. Proper reaction to changes in topology demands reconsidering all parametrizing.

1.1.8 Power-aware Routing Protocol

Energy required to transmit a signal is approximately proportional to d , where d is the distance and is the attenuation factor path loss exponent, which depends on the transmission medium**[15].** When (which is the optimal case), transmitting a signal half the distance requires one fourth of the energy and if there is a node in the middle willing to spend another fourth of its energy for the second half, data would be transmitted for half of the energy than through a direct transmission – a fact that follows directly from the inverse square law of physics. The main disadvantages of such algorithms are:

1. This method induces a delay for each transmission.

2. No relevance for energy network powered transmission operated via sufficient repeater infrastructure.

4. CLASSIFICATION OF Ad Hoc NETWORK:

Wireless ad hoc networks can be further classified by their application:

4.1. Wireless Mesh Network

A wireless mesh network (WMN) is a communications network made up of radio nodes organized in a mesh topology. Wireless mesh networks often consist of mesh clients, mesh routers and gateways. The mesh clients are often laptops, cell phones and other wireless devices while the mesh routers forward traffic to and from the gateways which may but need not connect to the

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Internet. The coverage area of the radio nodes working as a single network is sometimes called a mesh cloud. Access to this mesh cloud is dependent on the radio nodes working in harmony with each other to create a radio network. Wireless mesh networks can be implemented with various wireless technology including 802.11, 802.15, 802.16, cellular technologies or combinations of more than one type**[16,17].**

Applications of Wireless Mesh Network

Mesh networks may involve either fixed or mobile devices. The solutions are as diverse as communication needs, for example in difficult environments such as emergency situations, tunnels, oil rigs, battlefield surveillance, high speed mobile video applications on board public transport or real time racing car telemetry. Some current applications:

1.U.S. military forces are now using wireless mesh networking to connect their computers, mainly ruggedized laptops, in field operations.

2.Electric meters now being deployed on residences transfer their readings from one to another and eventually to the central office for billing without the need for human meter readers or the need to connect the meters with cables.

3.The laptops in the One Laptop per Child program use wireless mesh networking to enable students to exchangefiles and get on the Internet even though they lack wired or cell phone or other physical connections in their area.

4.The 66-satellite Iridium constellation operates as a mesh network, with wireless links between adjacent satellites. Calls between two satellite phones are routed through the mesh, from one satellite to another across the constellation, without having to go through an earth station.

4.2 Wireless Sensor Networks (WSN)

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, humidity, motion or pollutants and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity**[18].** The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Application of Wireless Sensor Network

Area monitoring is a common application of WSNs. In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors to detect enemy intrusion; a civilian example is the geo-fencing of gas or oil pipelines.

4.3 Mobile Ad Hoc Network (MANET)

A mobile ad-hoc network is a self-configuring infrastructure less network of mobile devices connected by wireless links. Ad-hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. The growth of laptops and 802.11/Wi-Fi wireless networking have made MANETs apopular research topic since the mid 1990s. Different protocols are then evaluated based on measure such as the packet drop rate, the overhead introduced by the routing protocol, end-to-end packet delays, network throughput etc. The mobile ad hoc network has the following typical features

- Unreliability of wireless links between nodes.
- Constantly changing topology.

5. Types of MANET

5.1 Vehicular Ad-hoc Networks (VANETs)

A Vehicular Ad-Hoc Network or VANET is a technology that uses moving cars as nodes in a network to create a mobile network. VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 metres of each other to connect and, in turn, create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile Internet is created. It is estimated that the first systems that will integrate this technology are police and fire vehicles to communicate with each other for safety purposes**[19,20].**

5.2 Internet Based Mobile Ad-hoc Networks

(iMANET) Internet Based Mobile Ad-hoc Networks are ad-hoc networks that link mobile nodes and fixed Internet-gateway nodes. In such type of networks normal ad hoc routing algorithms don't apply directly. Wireless networks can generally be classified as wireless fixed networks, and wireless, or mobile ad-hoc networks. MANETs (mobile ad-hoc networks) are based on the idea of establishing a network without taking any support from a centralized structure. By nature these types of networks are suitable for situations where either no fixed infrastructure exists, or to deploy one is not possible.

5.3 Intelligent vehicular ad-hoc networks (InVANETs)

InVANET, or Intelligent Vehicular Ad-Hoc Networking, defines an Intelligent way of using Vehicular Networking. InVANET integrates on multiple ad-hoc networking technologies such as WiFi IEEE 802.11, WAVE IEEE 1609, WiMAX IEEE 802.16, Bluetooth, IRA, ZigBee for easy, accurate, effective and simple communication between vehicles on dynamic mobility. Effective measures such as media communication between vehicles can be enabled as well methods to track the automotive vehicles is also preferred. InVANET helps in defining safety measures in vehicles, streaming communication between vehicles, infotainment and telematics. Vehicular Ad-hoc Networks are expected to implement a variety of wireless technologies such as Dedicated Short Range Communications (DSRC) which is a type of WiFi. Other candidate wireless technologies are Cellular, Satellite, and WiMAX. Vehicular Ad-hoc Networks can be viewed as component of the Intelligent Transportation Systems (ITS)**[21].**

6.CONCLUSION

In this paper, we study about Ad Hoc networks, its different protocols, different types of network namely WMN, WSN, MANET and various features and advantage of these networks explained. Further types of MANET networks which explains the concept if moving nodes in networks also discussed in detail. So the study of this network will be helpful to understand Ad Hoc networks and its various application area. The future scope of this research paper is to concentrates on improving more accurate and effective communication of these different network.

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