Review of Routing Algorithms in Wireless Sensor Networks

Monica Parmar[1], Saurabh Mishra[2],

[1]*M. Tech. (WMC), ECE Department, DIT University, Dehradun*
[2]*Assistant Professor, ECE Department, DIT University, Dehradun*

Abstract: *Wireless sensor networks are very broadly used in many applications. Sensor networks still have problems in conveying data from one sensor node to other node. Routing algorithms are developed for wireless sensor networks. In this paper, some of them are discussed. These protocols still have some problems in sensor networks. Ad hoc networks and WSNs are similar to each other as both depend on hop-to-hop routing. So, protocols developed for ad-hoc networks are also used in many sensor applications. But sensor nodes are not much capable for these protocols.These protocols with some changes can be used in sensor networks.In this paper ADSR is discussed, which is developed for WSNs and derived from changes done in DSR, which was developed for MANETs. Moto of this paper is to give an idea that other protocols which were developed for MANETs can be completely used in WSNs, by having angle-based mechanism, as described in ADSR.*

Keywords:*Wireless Sensor Networks, Mobile ad-hoc networks, routing algorithm, ADSR.*

I. Introduction

Wireless sensor networks (WSNs) have many wirelessly connected sensor nodesspread over any region or area to take control or maintain many environmental or physical conditions.WSNSs are used in various applications, e.g. to monitor area, heath care, air pollution etc., to detect forest fire, landslide etc.WSNs are popularizing nowadays because they are flexible, cost-effective, reliable, easy to deploy and accurate. WSNs are mainly designed for sensing, collecting and disseminating information about environmental conditions. All sensor nodes sense the difference then collects important information and then sends it to base station or gateway by multi hop communication. WSNs firstly convert data into radio waves and then amplify it and then radio waves are received at receiving node.In many applications of WSNs routing is based on the routing algorithms developed for mobile ad-hoc networks. WSNs are usually very similar to mobile ad-hoc networks (MANETs).As both are distributed network connected wirelessly, use hop-to-hop routing for communication and are battery powered.

MANETs are mostly used for communication purposes and to transfer data from one device to another device through internet.But both are different in many points. Nodes used in WSNs have very limited memory power and are of very high magnitude i.e. in order of many hundreds, as compared to MANETs. For WSNs communication is not very big issue, but collecting data is more important, while in MANETs communication is the only purpose. Because of so many differences routing mechanism for WSNs should be different.

In this paper, different types of routing algorithms developed for wireless sensor networks are discussed. A new approach is considered for mobile wireless sensor networks.Section II describes about different models of sensor networks. Section III gives an idea about routing algorithms developed for WSNs. Section IV the approach used in ADSR is describedSection V describes conclusion and future work, regarding the paper.

II. Models Of Wireless Sensor Networks

Sensor nodes used in wireless sensor networks can be fixed or mobile. So, according to this WSNs can be classified in two types:
- Static Wireless Sensor Networks
- Mobile Wireless Sensor Networks

These are briefly discussed as follows:-

a) Static Wireless Sensor Network

Static wireless sensor network, haveall nodes fixed at one place, i.e. there is no motion among the nodes placed in the sensor networks.This type of network model is reliable, easy to implement. To communicate between two nodes is simple as all the nodes are static.

b) Mobile Wireless Sensor Network

In mobile wireless sensor networks (MWSNs), nodes are mobile, i.e. nodes can move from place to place. Due to which communication between two nodes can be very complicated. Routes selected for

communication also have to change with respect to movement of nodes.Node which has to transfer the data, called source node, and node to which the data has to be sent is called sink node. But MWSNs are more advantageous over static WSNs in terms of
MWSNs can be further divided in two parts: (i) Sensor networks with mobile source node and (ii) sensor network with static source node.

III. Routing Algorithms

WSNs have many routing algorithms, each one of these protocols is developed for specific application. Every protocol is developed to work only in its desirable condition or environment. Some of them are described here. In WSNs, routing protocols used have flat, hierarchical or location-based structures. Hierarchical routing protocols are Low Energy Adaptive Cluster Hierarchy (LEACH), Two Level Hierarchy LEACH (TL-LEACH), Threshold sensitive Energy Efficient sensor Network protocol (TEEN), Adaptive TEEN (APTEEN), Energy Efficient Cluster Scheme (EECS), Hybrid Energy-Efficient Distributed clustering (HEED), Power Efficient Gathering in Sensor Information System (PEGASIS) and CCS.

A new algorithm namely e3D is also proposed. To maximize information flow 2 more protocols are also proposed, i.e. Maximum Information Routing (MIR) and Conditional MIR (CMIR). These are better than LEACH, PEGASIS and Geographical and Energy aware routing (GEAR) on number of hop count. GEAR is a location-based routing protocol which uses energy aware and geographical informed neighbor selection heuristic to route a packet towards the target region. A best hop algorithm is proposed to a Wireless sensor network Longevity (CRAWL) used for scalability and adaptability feature with 20% longer network life. An intra-cluster routing algorithm is used for high density WSNs. Energy-Efficient Minimum Routing algorithm (EEMR) improves energy utility in sensor network by changing activity of wireless communication module. It is better in high density deployment and low traffic.

An adaptive transmission range assignment algorithm for in-routing image compression (ARIC) was also proposed which uses collaborative image compression to distribute the computational cost among the sensor nodes. This method had shown the increased lifetime of the network. Geographical routing based algorithm i.e. Energy Efficient Geographic Routing Algorithms interferences and computational costs.

To achieve 100% coverage a new protocol named Adaptive Coverage –Preserving Routing Protocol(ACPRP) is proposed. ACPRP uses Particle Swarm Optimization (PSO) algorithm, to find optimal weight parameters which are fed into cluster head mechanism and hierarchy routing selection mechanism. Accuracy of data transmitting node and increase in energy efficiency of sensor node is also necessary are also important issues in sensor networks. So, a new algorithm was proposed to cover these issues named as A Trust Degree of node based on Aware Routing Protocol (TDAR). TDAR uses energy aware mechanism, gives extended network lifetime and improved reliability of data transmitting in networks.

In multi-hop routing algorithms, low-power radio properties are ignored, so a novel link loss tolerant data routing protocol, called TABS (Try-Ancestors-Before-Spreading) was designed. TABS combines the benefits of wireless network broadcast advantage with traditional retransmission based routing. It eliminates the need of periodic link quality estimation or backlisting and is designed for both static and dynamic topologies. Shortest Path Routing Protocol (SPRP) is a new routing algorithm designed for wireless network, which uses the Dijkstra's algorithm for choosing shortest path.

A beaconless multi hop routing protocol (BMR) is developed to achieve energy efficiency in sensor networks for prolong network lifetime. BMR is light weight, energy efficient and makes routing decisions based on residual energy of nodes. For energy efficiency a protocol named Correlation based Collaborative Medium Access Control (CC-MAC) is also proposed. CC-MAC used spatial correlation based medium access control protocol compared with IEEE 802.11.

A gradient-based routing algorithm for load balancing (GLOBAL) is also proposed, with a gradient model to increase lifetime of the sensor network. In GLOBAL each sensor node determines its gradient by a weighted average of the cumulative path load and traffic load of the most overloaded node over the path. GLOBAL uses least-loaded path for forwarding.

IV. New Algorithm

WSNs have still have problems w.r.t. routing algorithms. So, need of new algorithms are very necessary for development of sensor networks. As we all know that Mobile ad-hoc networks have various range of routing algorithms, as MANETs and WSNs are very similar to each other. These protocols developed for MANETs can be used in wireless sensor networks with some modification in algorithms.

ADSRuses an angle-based algorithm for WSNs. In this algorithm mainly DSR is used, which is a common routing protocol in ad-hoc networks. Basic idea of ADSR is that the angle between source node, an intermediate node and sink node is measured, if the angle is greater than threshold angle, then the request is

dropped and new request will be generated by the source. If the measured angle is smaller than the threshold angle, then the request is forwarded to the sink node through that intermediate node.
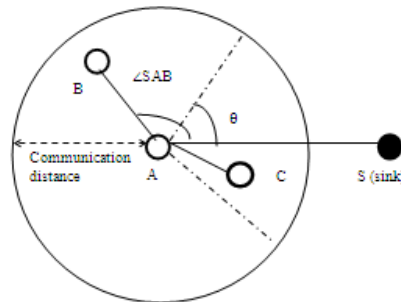

Fig. Idea of ADSR

As in fig. node A sends route request packet, node B and node C received the request, and both of them will send route reply packet to node A. As ∠SAB is greater than θso request from node B will be dropped whereas ∠SAC is smaller thanθ, so request is forwarded to the sink node through node A.

The purpose of this paper is that using basic idea of ADSR, i.e. angle based mechanism, many more routing algorithms can be developed by using MANET routing protocols. As in ADSR, DSR is used, similarly other protocols as DSDV, AODV etc. can be used with this angle based algorithm and new protocols for WSNs can be developed. By this method WSNs can also have vast range of routing protocols for different applications. And problem of limitation of routing algorithms in WSNs can be removed.

V.   Conclusion & Future Work

In this paper different routing protocols, which are developed for wireless sensor networks, have been discussed. And a solution to most common problem for WSNs is proposed, i.e. an idea for developing a new protocol for sensor networks with the help of other routing protocols, which were basically developed for ad-hoc network.In our future work, the angle-based mechanism will be used in other routing protocols of MANET. This effort will providenew routing algorithms for WSNs. Algorithms of protocols e.g. AODV, DYMO, DSDV, OLSR, etc will be slightly changed by adding angle-based mechanism to it.

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