Concept of ADSR for Mobile AdHoc Networks/Wireless Sensor Networks

Saurabh Mishra 1,*, Sandip Vijay 2

1 ECE Department, DIT University, Dehradun, Uttarakhand, India
2 ECE Department, ICFAI University, Dehradun, Uttarakhand, India

Abstract—Wireless AdHoc and sensor networks are very broadly used in many remote applications. AdHoc networks still have problems in conveying data from one node to other node. This problem further increases with the mobile nodes. Now a days different routing algorithms are being developed for mobile wireless AdHoc networks. In this paper, some of them are discussed. Mobile Ad hoc networks and Mobile Wireless Sensor Networks are similar to each other as both depend on hop-to-hop routing. So, protocols developed for Mobile ad-hoc networks are also used in many Mobile sensor applications. In this paper Angle based DSR is discussed, which is developed for Mobile AdHoc networks or mobile Wireless Sensor Networks 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 Mobile WSNs, by having angle-based mechanism, as described in ADSR.

Keywords—Mobile Wireless Sensor Networks; Mobile Ad-hoc Networks; Routing algorithm; Angle based DSR.

I. INTRODUCTION

AdHoc networks (MANETs) use to have many wirelessly connected mobile nodes spread over any region or area to take control or maintain many environmental or physical conditions. MANETs are used in various applications, e.g. to monitor area, health care, air pollution etc., to detect forest fire, landslide etc. MANETs are popularizing now a days because they are mobile, flexible, cost-effective, reliable, easy to deploy and accurate. MANETs are mainly designed for collecting and disseminating information about environmental conditions and any other specific purpose. Mobile AdHoc Networks can be treated as Mobile Wireless sensor nodes if the nodes can act as a sensor and transceiver simultaneously. All mobile sensor nodes collects important information and then sends it to base station or gateway by multi hop communication [1]. 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. Mobile WSNs are usually very similar to mobile ad-hoc networks (MANETs). As both are mobile in nature, distributed network connected wirelessly, use hop-to-hop routing for communication and are battery powered [1]. 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 Mobile WSNs have very limited memory power and are of very high magnitude i.e. in order of many hundreds, as compared to MANETs. For Mobile 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 Mobile WSNs should be different [1]. In this paper, different types of routing algorithms developed for MANETs and Mobile Wireless sensor networks are discussed. A new approach is considered for mobile AdHoc networks. Section II describes about different models of MANETs and Mobile Wireless Sensor Networks. Section III gives an idea about routing algorithms developed for MANETs/WSNs. Section IV the approach used in ADSR is described. Section V describes conclusion and future work, regarding the paper.

* Corresponding author can be contacted via the journal website.
II. MODELS OF AdHOC NETWORKS

Nodes used in AdHoc Networks or wireless sensor networks can be fixed or mobile. So, according to this AdHoc Networks/WSNs can be classified in two types:

A. Static Networks
B. Mobile Networks

These are briefly discussed as follows:

A. Static Networks
Static AdHoc Networks or wireless sensor network, have all nodes fixed at one place, i.e. there is no mobility among the nodes placed in the AdHoc / sensor networks. This type of network model is reliable and easy to implement. It is easy to communicate between two nodes as simple as all the nodes are static.

B. Mobile Networks
In Mobile AdHoc Networks (MANETs) or wireless sensor networks (MWSNs), nodes are mobile, i.e. nodes can move from place to place. Due to mobility of nodes communication between two nodes can be a little complicated as compared to static networks. Routes selected for communication also have to change with respect to movement of nodes [2]. Nodes which initiate transfer of the data, is called source node, and node to which the data has to be sent is called sink node.

III. ROUTING ALGORITHM

Ad Hoc network routing protocols can be classified on the basis of routing information update mechanism.

The three major categories based on the routing information update mechanism are [3]:

A. Proactive or table driven routing protocols.
B. Reactive or on demand routing protocols.
C. Hybrid routing protocols.

A. Proactive (table driven) routing protocol

This type of protocol is mainly used when the number of nodes and the coverage area is fixed for most of the time but can be changed as per the need. There is network topology information in the form of a table at every node. This information is updated time to time by flooding the updated information in the network. This updated information exchange will take place even if there are no actual data packets in the network. e.g. Optimized Link State Routing (OLSR), Topology Dissemination Based on Reverse Path Forwarding (TBRPF), DSDV: Destination-Sequence Distance- Vector.

B. Reactive (on demand) routing protocol

As per the name suggest the protocol search path only when needed. The path finding algorithm runs from source to destination only when there is some data to be transmitted. There is no existing path between the nodes. The nodes do not maintain any network topology information e.g. Dynamic Source Routing (DSR), Associativity- Based Routing (ABR), Ad-hoc On-demand Distance Vector (AODV), Temporarily Ordered Routing Algorithm (TORA).

C. Hybrid routing protocol

This category of protocols modifies themselves as per the demand. They combine the useful characteristics of both proactive and reactive protocols. They may become proactive for smaller coverage area and become reactive for larger area, e.g. Zone Routing Protocol (ZRP).

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 [4]. A new algorithm namely e3D is also proposed [5]. 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 [6]. GEAR is a location-based routing protocol which uses energy aware and geographical informed neighbour 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[7]. Energy-Efficient Minimum Routing algorithm (EEMR) improves energy utility in sensor network by changing activity of wireless communication module [8][9]. 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 [10],[11]. 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 [12]. 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 [16]. 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 [13]. TABS combines the benefits of wireless network broadcast advantage with traditional retransmission based routing. It eliminates the need of periodic link quality estimation or back-listing 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 [14]. A beaconless multi hop routing protocol (BMR) is developed to achieve energy efficiency in sensor networks for prolong network lifetime [15]. 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 [8]. A gradient-based routing algorithm for load balancing (GLOBAL) is also proposed, with a gradient model to increase lifetime of the sensor network [16]. 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.

The above mentioned routing protocols can be applicable for different Mobile AdHoc Networks (MANETs) and Mobile Wireless Sensor Networks with the different mobility model.

IV. NEW ALGORITHM

In current approach Dynamic Source Routing (DSR) protocol is modified for pedestrian mobility model using Angle based approach.

A. DSR

It operates for relatively small network diameter. This is an on demand routing protocol. The process of route discovery is issued with exponential back off intervals. For instance if A wants to deliver the data packet to G it will send the route request to its nearby nodes. The route reply will come to A and the smallest path is selected, all the other paths are rejected. It support unidirectional as well as bidirectional links [3].

B. ADSR

In case of Mobile AdHoc Networks (MANETs) / Mobile Wireless Sensor Networks WSNs have still have problems with respect to 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.

ADSR uses an angle-based algorithm for MANETs/Wireless WSNs. In this algorithm mainly DSR is used, which is a common routing protocol in ad-hoc networks [17]. This approach of ADSR is applicable for the Pedestrian Mobility models only due to the low mobility of the nodes. 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.

As shown in figure, let the sink node $S$ is stationary and all nodes in the networks are mobile with the Pedestrian mobility model in horizontal $\pm x$ direction. In this approach the mobility of nodes is assumed to be small so that the computing time at the node is small enough as compared to the stationarity of the node. Let 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 $\angle SAB$ is greater than $\theta$ so request from node B will be dropped whereas $\angle SAC$ is smaller than $\theta$, 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 and Mobile Wireless Sensor Networks. 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 AND FUTURE WORK

In this paper different routing protocols, which are developed for Mobile AdHoc Networks (MANETs) and Mobile Wireless Sensor Networks, have been discussed and a solution to most common problem for Mobile AdHoc Networks (MANETs) and Mobile Wireless Sensor Networks is proposed, i.e. an idea for developing a new protocol for 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/MWSN. This effort will provide new 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.

ACKNOWLEDGMENT

First author would like to acknowledge the consistent motivation of his guide Dr. Sandip Vijay and the DIT University for providing the research opportunity.

REFERENCES


