Power Aware Location Aided Routing

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***Abstract*— Routing is the process of transferring the data packets across the network from source node to destination node by selecting a suitable path. It is the responsibility of routing protocol to find the optimal path in terms of bandwidth, delay, and energy consumption of nodes. Due to lack of infrastructure, routing in MANET's undergoes lots of challenges. Existing protocols are largely acceptable for the provision of communications services on a best-effort basis. Existing routing protocols deals mainly with bandwidth and delay factors. But from the application point of view, it is required that the routing protocol should be efficient enough to find the path with minimum bandwidth consumption, minimum delay and efficient battery consumption. This paper presents an optimized approach for reducing the bandwidth consumption with effective utilization of battery power.**

***Keywords*— Bandwidth, Battery Power, GPS, MANET, routing.**

I. INTRODUCTION

A mobile Ad hoc network (MANET) is collection of mobile nodes which are without any central administration and are capable of creating the network topology randomly. Thus, the task of routing the data packets along with Quality of Service (QoS) and energy consumption becomes very important. But, because of various limitations of ad hoc network it is very difficult task to provide QoS in MANET.

Current generation of mobile applications has attracted the interest of large number of researchers. Today's research in the area of MANET is mainly focused on providing a routing protocol which would be able to deal with the issues such as bandwidth, delay, limited battery power, packet drops due to change in topology, high throughput etc. Earlier protocols used either proactive (table-driven)[1,2] or reactive (on-demand) approach [3,4,5,6,7]. Table driven approach requires a large amount of storage space to store the information regarding whole of the network which is not possible in case of small mobile devices. On the other hand, due to flooding of RREQ packets, on-demand routing protocols consumes a large amount of bandwidth and thus increases the network load. Also, there is a transmission delay for the first data packet. This paper tries to provide QoS (bandwidth, delay, energy, throughput) using the Global Positioning system.

In literature many routing protocols have been proposed for efficient routing [1,2,3,4,5,6,7,8]. Table driven protocols maintain information about complete network. In order to select the best node, they perform large number of calculations resulting in premature loss of battery life. On-demand routing protocols find the route by flooding the routing packets in all directions irrespective of the location of the destination node which causes the increase in bandwidth consumption. This bandwidth consumption was reduced by the Location Aided Routing Protocols [9,10,11,12,13]. Location based routing protocols make use of the Global Positioning System (GPS) [14] to find the path to the destination. This will help in decreasing the bandwidth consumption, delay and save the energy of the node which are not present in the direction of destination node. Thus, help in increasing the network life. This paper present a new routing protocol called Power Aware Location Aided Routing (PALAR). The proposed protocol is based on Directional Anteena Multi-Path Location Aided Routing (DA-MLAR) [15] protocol. PALAR is a location aware based routing approach which also uses the concept of energy requirement. This approach will help in decreasing the routing overhead. Rest of the paper is structured into following sections. Section II will provide review on the existing routing protocols in location aware environment. Section III describes the proposed protocol. Section IV will present conclusion.

II. RELATED WORK

Data transmission in ad hoc network is dependent on the bandwidth. But in the absence battery power, no data can be transmitted. So, conservation of energy in ad hoc environment is equally important. And if the node is the only intermediate node between two networks, it becomes necessary to save the energy of this crucial node.

Global positioning system (GPS) is very useful in finding the forwarding region of packet. Using the location information of source and destination node, it would be easy to restrict the forwarding the packet only in the direction of destination node. An intermediate node forwards the packets to next intermediate node only if it lies in with in the forwarding region. GPS plays the most vital role in all the location based routing protocols like DREAM, LAR, LARDAR, ILAR [9,10,11,12] etc.

DA-MLAR [15] is location based technique which uses the concept of base line lying in between the source and destination node. Node which is closest to this line of sight will be chosen as the next intermediate node. DA-MLAR uses the concept of directional antenna. The direction from source to destination is calculated as shown in Fig. 1. If S is the Sender, D is the receiver and θ is the angle made to the horizon, then direction of D from S is given by,

$$\theta = \tan^{-1}\frac{y2 - y1}{x2 - x1} \quad \text{——} \quad \textbf{(1)}$$

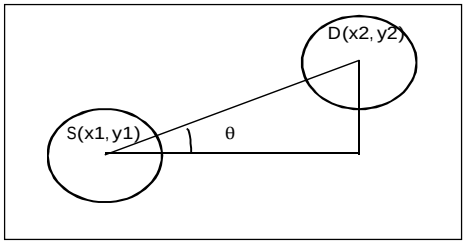

Fig.1. Forwarding Zone in DA-MLAR

Here, (x1, y1) and (x2, y2) are the locations (co-ordinates) of S and D respectively. In practice this location information can be obtained from GPS chip embedded in each node.

As the transmitting node check the angle of θ of every neighbouring node from base line and the node having less value for θ will be chosen as the next intermediate node. This protocol helps in reducing the bandwidth consumption. But it does not take care of the required battery power for transmission and available power on the node. If the node does not have the required battery power, it would not be helpful in forwarding the packet and cause the packet drop. This in turn will increase delay and reduction in throughput. Thus, it becomes a mandatory requirement to send the packet having required battery power.

PALAR (Power Aware Location Aided Routing) will overcome this problem by sending the information about required battery power in the packet header. This will reduce the number of packet drops and will be helpful in increasing the throughput along with bandwidth conservation.

III. PLAR The Proposed Protocol

Terminology Used: In order to understand the proposed protocol we first need to understand the concept of expected zone and request zone.

Expected Zone: Let node S generates a request for data transmission to node D at time T. Assume that S knows the location of D at time Ti. Also velocity (VD) with which node D is moving is also known to S. Maximum distance traveled by D in any direction can be calculated as:

$$r = VD\,(T - Ti) \qquad (2)$$

As node is free to move in any direction, so the expected region will be a circular area of radius D shown in Fig. 2.

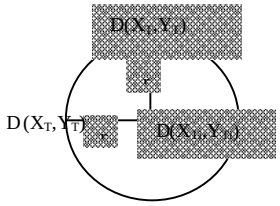

Fig. 2. Expected Zone

Forwarding Zone: Forwarding zone is the area where the request packets are sent or broadcast to find a path from source to destination. In the traditional routing algorithms it is the complete network. For eg. In AODV, DSR, etc. RREQ packet is broadcasted in all directions to find the optimal path from source to the destination node. LAR tries to minimize the request zone by confining it to the smallest rectangular area containing both sender as well as receiver (Fig.3.). Whereas, DA-MLAR used the concept of base line. Nodes having less value for angle θ will be chosen as the next node. As, this node will be closer to the base line.

The proposed protocol PALAR will use the concept of power awareness along with the concept of closest node to the base line. Here, in PALAR node which is closer to the base line and having battery power equal or greater than the required threshold power will be chosen as the next intermediate node.

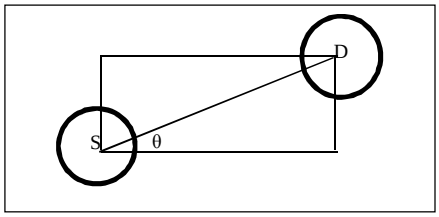

Fig.3. Request zone and Expected zone in

Steps involved in PALAR for data transmission from source to destination are as follows:

1. Source node will flood the Route_Request (RREQ) (Fig.4.). Packet along with the destination co-ordinates, Required Battery Power (RP) and the angle θ to one hop neighbors.
2. On receiving the RREQ packet all the nodes will check for the destination address. If the packet is destined to the node, node will consume the packet and send a Route_Reply (RREP) packet to the node from which it has received the RREQ Packet. Sender node will then send the data packet to the destination node.
3. If receiving node is not the destination node, then it will check for the availability of the remaining battery power. If remaining power is less than RP, node will drop the RREQ packet. Else, node will calculate angle θ' between source and itself. If angle θ' is more than θ then node will drop the packet. Else node will forward the RREP packet along with its own address and angle θ'.
4. At the sender node, node will wait for limited amount of time for the RREP fro one hop neighbors. On receiving the RREP packet, sender will compare the angle θ' received from all the neighboring nodes. Node with the least value of θ' will be chosen as the next node for data transmission as it is closer to the base line.

5. Sender node will also check for the visited node. If chosen node is already present in the list of visited nodes (L_V_N) in the data packet, chosen node will be discarded. Another node with the least value of θ' will be chosen as the next intermediate node. This will help in loop avoidance in the forwarding zone.
6. Sender node will then append its own address in the L_V_N and then send the Data Packet to the chosen node and the same process will continue till the data packet reaches the destination node.

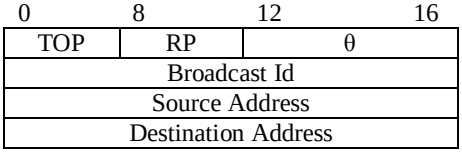

Fig.4. Format of Route Request Packet

IV. Conclusions

This paper has presented a protocol (PALAR) for routing packets between mobile nodes in an ad hoc network using the Global Positioning System. Unlike routing protocols like LAR, ILAR, LARDAR our protocol considers various parameters like bandwidth requirement and battery life of all the intermediate nodes on a path to destination. PALAR not only help in decrease in bandwidth width consumption bout also help in efficient use of battery life along with the avoidance of loop.

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