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Efficient Utilization of Bandwidth in Location Aided Routing

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Abstract : *Earlier work on routing MANETs developed several routing protocols, which finds available route from source to destination without taking into the consideration of Band width availability for data transfer, and they frequently fails to discover stable routes between source and destination. As a result of that there is a large numbers of discarding of data packets as well as overloading of packets as the consequences of that large wastage of band width. EUBLAR (Efficient Utilization of band width in Location Aided Routing) protocol is introduced in this proposed work, which is capable of calculating the available band width of all the intermediate nodes between source and destination. In this proposed protocol find the minimum available band width of all the intermediate nodes between source and destination and then according to that band width sends the data packets over that path. The EUBLAR can effectively utilized the wastage of band width and every single band width can be used for data transfer can be used over entirely configured network. In this way we can increase the quality of service of the Ad- hoc network in terms of bandwidth.*
Keywords: *Ad Hoc Networks, Global Positioning System, Maximum & Minimum slopes, Minimum available Bandwidth, Time to Live*

I. INTRODUCTION

Nowadays, in the competitive world, wireless communication between the mobile users is becoming more popular than it was even before. Every single person in this world makes use of wireless communication. This can happen only because of recent technological advances in lap top computer and wireless data communication devices, such as wireless modems and wireless LANs. This has lead to the lower prices and enabling us to higher data rates, are the two main reasons why mobile communication continues to go for a rapid growth.

Military as well as the civilian World, both are taking advantages of mobile network. Initially enhancing military communications in the battle field or in the areas hit by natural disasters, wireless network with the time being spent, found their way into civilian life also. Nowadays, people are using these networks in colleges, universities, schools, companies, cafes, and public gathering, such as conferences etc.

Wireless network consist of numbers of nodes communicating over a wireless channel. Wireless network basically divided into two main category i.e. Infrastructure base wireless networks and mobile Ad – Hoc Network (MANETs). In case of Infrastructure base wireless networks, all the nodes communicate directly with the base stations that are responsible for controlling all transmission and forwarding data into intended users.

In case of mobile Ad – Hoc Network (MANETs), mobiles nodes communicate directly with each other and without the use of access point and we can say that they have no fixed infrastructure. The nodes in MANETs may be routers or hosts.

In mobile Ad – Hoc Network, all the nodes form an arbitrary topology, where the routers are free to move in any random fashion and they can arrange themselves as required.

II. RELATED WORK

In recent times the use of GPS (Global Positioning System) is quite often in routing protocols and there are many routing protocols have been proposed which make the use of GPS. GPS scheme uses the concept of forwarding region. An intermediate node forwards the data packets to next intermediate node only if it lies in with forwarding region. The GPS plays an important role in all location based routing protocols like LAR, LARDAR, ILAR, LBPAR, ELBPAR etc.

LAR (Location Aided Routing) [3] is an on demand routing protocol which uses the location information to identify the request zone and expected zone. Request zone in this protocol is the rectangular area including both the sender as well receiver. This protocol helps in decreasing the routing overhead by decreasing the search area.

ILAR (Improved Location Aided Routing) [7] is another location based technique which uses the concept of base line lying in between the source and destination node. Node which is closest to line of sight will be chosen next intermediate node. The transmitting node checks the distance of every neighboring node from base line and find the closest neighbor for further transmission. This process will increase delay in data transmission and also increase the nodal overhead and in turns decrease the battery life.

LARDAR (Location Aware Routing Protocol with Dynamic Adaption of Request Zone) [6] is an on demand routing protocol which decreases the search area given by LAR. In LAR search area is smallest rectangle containing both sender as well as receiver. LARDAR reduces this rectangle to triangle zone, which help in reducing the routing overhead.

LBPAR (Location Based Power Aware Routing) [4] is also an on demand routing protocol which is very similar to LARDAR and uses the concept of triangle zone. But instead of using angular values in route request packet as in LARDAR, in this concept of slope of lines given which reduces the further calculations.

In Enhance Location Based Power Aware Routing [5] a power aware routing approach is suggested which helps to decreasing the routing overhead by utilizing the concept of global location information and provide optimal path in terms of bandwidth. In this approach a threshold value of bandwidth is selected and when all the intermediate nodes of the network have bandwidth more than the threshold value then optimal path is created between the Source and Destination.

2.1Problem Statement

By using ELBPAR and NSAR, we can find out stable path in terms of bandwidth between source to destination, but ELBPAR protocol used as a threshold band width value for every intermediate node. If intermediate node available band width is greater than or equal to threshold value then that node will be used as intermediate node otherwise discard the intermediate node RREQ packet.

For example : If threshold value of band width is 10 kbps and available band width is 9.9kbps or 8.5kbps then packet will be discard and we are not able to utilize the available band width of intermediate node due to threshold value. But 9.9 kbps or 8.5 kbps is useful amount of band width on intermediate node. And it should be basic requirement to utilize this minimum amount of available band width in certain way.

III. PROPOSED WORK

The proposed protocol is an efficient routing scheme which effectively utilized the band width in Location Aided Routing. "Efficient utilization of Band Width in Location Aided Routing" (EUBLAR) resolve the problem occur in ELBPAR protocol and this protocol provides better results in terms of route discovery success rate, packet delivery rate and most importantly utilization of minimum available band width in intermediate node which got wasted in case of ELBPAR. EUBLAR also uses AODV protocol to find out routes from source to destination.

This EUBLAR protocol firstly finds the minimum available band width of all the intermediate nodes from the available band width list of packet header at the destination. After getting the minimum available band width, destination sends the route reply packet with minimum communication band width over that network by using the same path. For example: in a network node 1 having a band width of 10 Kbps want to send its data packets to node 5 having band width of 15 kbps threw intermediate nodes 2, 3, 4 and having band width 6 kbps, 5 kbps, 9 Kbps respectively, then at the destination point minimum available band width of intermediate node will check so that for eg. In this case it is of 5 Kbps. Then destination sends the route reply packet to source with minimum communication band width of 5 Kbps over the same path. Then it is up to source to sends the data packet according to minimum available band width of 5Kbps over that path. In this way, we can increase the data packet delivery rate as well as can found maximum communication path. And most importantly the minimum band width which gets wasted in other protocol can be efficiently used. By using all the minimum available bandwidth of intermediate nodes we can increase the quality of the service.

3.1 Band Width Calculation

The proposed protocol firstly selects the routes among which the data transfer will take place and then calculate the minimum available band width.

The band width can be calculated by considering channel busy time, channel idle time, packet transmission time, packet retransmission time under collision conditions and hand shaking time.

$$\mathbf{BW} = \frac{Tidle}{Tidle + Ttx + Trtx + Ths} \times \mathbf{C} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\mathbf{(1)}$$

Where Tidle = Idle time in Interval T

C = Channel capacity

T is interval comprising following time periods.

T_{tx} : Time taken for actual transmission of data

T_{rtx}: Time taken for retransmission of packets

T_{hs}: Time taken for four way handshaking.

3.2 Route Discovery Phase of EUBLAR

S (Xs,Ys) is the source node which want to communicate with destination D (Xd,Yd) in Figure 3.1 and 1,2,3,4,5,6,7 are intermediate nodes. Source node S calculate expected zone by using destination coordinate and then calculate the requested zone by using the expected zone. Source node S initiate the RREQ request, that packet contain the information like TTL, min_slope, max_slope, min available BW, broadcast id, source address, and destination address show in Figure 3.1. All these information is collected by source node before sending the RREQ packet to his neighbors. When source node neighbors receive the RREQ packet then first of all it check the destination address of RREQ, if destination address is the address of any one of the neighbor node then it consume the packet and send RREP packet to the source node.

If destination address is not equal to the neighbor node address then it check the value of TTL, if TTL is less than or equal to zero the node discard the RREQ, else it calculate the slope from source node. If slope lies between the maximum slope and minimum slope, then attach its own address to list of visited node and forward the RREQ packet to its neighbor nodes. If route can qualify neither minimum slope nor maximum slope, then node discard the RREQ packet or any one of this parameter then discard the RREQ packet. This process is follows by every node which receive the RREQ packet until the RREQ receiver by destination node.

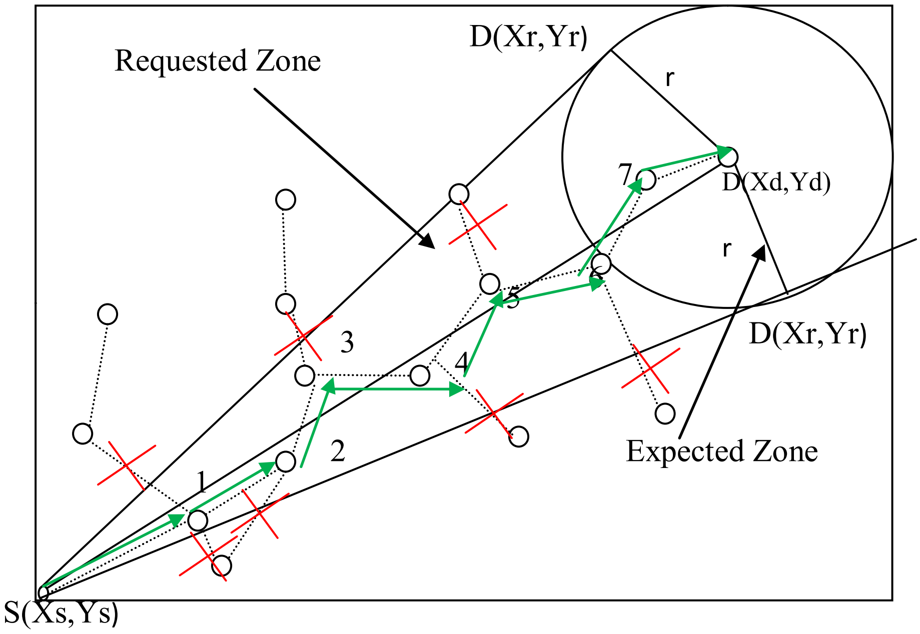

Figure 3.1 Route Discovery process of EUBLAR

```
If(TTL >= 0)
{
If (node-id= = dest-id)
{
Consume packet;
Find minimum available-BW from AB List;
Send RREP to source with minimum communication BW;
}
Else if (node-id! = dest-id)
{
Calculate Mn;
If(M1 > Mn > M2)
        {
        Enter the address of node-id to the visited node list;
        Enter the node-BW into AB List;
        Flood the RREQ;
        }
        }
        }
Else
{
Drop the packet;
}
```

Figure 3.1 is an example of route discovery process of EUBLAR which find the path between source need S and destination node D. Source node S to destination node D path is S-1-2-3-4-5-6-7-D.

3.3 Route Reply Phase of EUBLAR

In route reply phase if destination receives the RREQ packet then it checks the packet header destination address. If destination address is the address of node then it check minimum and maximum slope. If slope lies between these two slope then it will consume the RREQ packet and find the minimum available bandwidth from AB List in a packet header and then sent RREP packet to source node with minimum communication bandwidth via same path which path is use to receive RREQ packet from source to destination. Otherwise it will discard the RREQ packet. Figure 3.3 shows the route reply path from destination to source node as D-7-6-5-4-3-2-1-s.

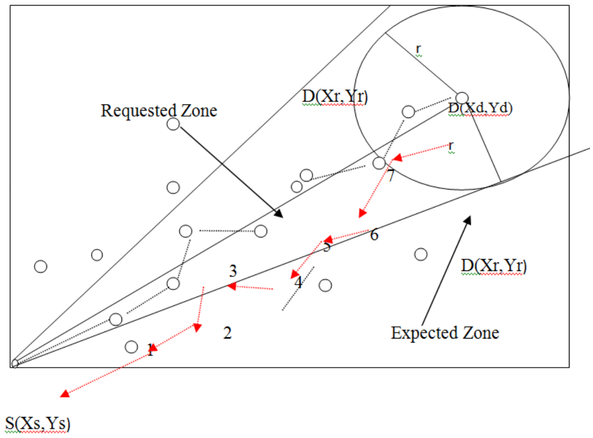

Figure 5.6 Route Reply Phase of EUBLAR

IV. COMPARISON WITH ELBPAR

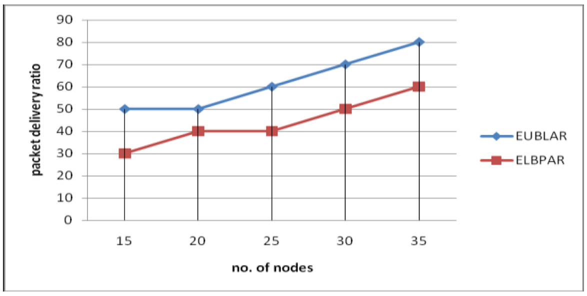

Figure 4.1 Comparison of EUBLAR with ELBPAR

Figure 4.1 shows the comparison between EUBLAR and ELBPAR protocol in terms of packet delivery ratio (%) and different number of mobile nodes. When the number of nodes increase, then the packet delivery ratio increases in both the protocols but EUBLAR provides better packet delivery ratio than ELBPAR due to bandwidth factor.

In ELBPAR, threshold value of bandwidth is considered due to that in some cases where the value of bandwidth in any of the intermediate node is less than that of threshold value then whole network gets failed and packet delivery is not possible in that case but EUBLAR protocol do not take the reference of threshold value and calculate the minimum available bandwidth of all the intermediate nodes between source and destination. In this way by calculating the minimum available bandwidth of all nodes source can transmit the data packets according to the minimum available bandwidth. In this way packet delivery ratio is increased in case of EUBLAR as compared to ELBPAR.

V. CONCLUSION AND FUTURE WORK

Earlier work on routing MANETs developed several routing protocols, which finds available route from source to destination without taking into the consideration of Band width availability for data transfer, and they frequently fails to discover stable routes between source and destination. As a result of that there is a large numbers of discarding of data packets as well as overloading of packets as the consequences of that large wastage of band width. EUBLAR (Efficient Utilization of band width in Location Aided Routing) protocol is introduced in this proposed work, which is capable of calculating the available band width of all the intermediate nodes between source and destination. In this proposed protocol, we find the minimum available bandwidth of all the intermediate nodes between source and destination and then according to that bandwidth we send the data packets over that path. The EUBLAR can effectively utilized the wastage of bandwidth and every single band width can be used for data transfer can be used over entirely configured network. In this way we can increase the quality of service of the Ad- hoc network in terms of bandwidth.

"Efficient Utilization of Bandwidth in Location Aided Routing" helps to deal with one of the most important performance factor of Mobile Ad hoc networks. i.e Bandwidth. But as we select all the nodes without considering any threshold value, so this can slow down the data rate because of increase of time to send data from source to destination as the bandwidth of some intermediate nodes can be very low and we have to send data according to the node with the minimum bandwidth. This protocol can further be improved in future by increasing the data rates.

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