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A Direct Routing Algorithm with Less Route Built Throughput

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Abstract. Because of the development of the digital technology and the electronic science, and also because of the promotion of the wireless network technology, the network transmission speed increases much fast. There are many types of routing protocols in MANET and VANET which are used in the network of vehicle environment. No matter which kind of protocol it is, almost all the protocols contain route discovery procedure, route maintenance procedure, and route repair procedure. But there are a few disadvantages of these steps especially in the aspect of transmission speed. In this paper, we propose a new data transmit algorithm to increase the network throughput and the data transmission speed by deleting those three route building procedures.

Keywords: VANET, Data Transmit, Route Built, Node Map, Sector Area

1. Introduction

Because of the development of the digital technology and the electronic science, and also because of the promotion of the wireless network technology, the network transmission speed increases fast. In the past few years, most of the research about wireless network has been focused on needed Wireless LAN (WLAN), but recently the vehicular Ad-Hoc network (VANET) which comes from the mobile Ad-Hoc network has become a very hot issue.[1][2]

The node status in VANET and MANET are different. In a MANET environment, there is no limitation on the node movement or velocity. However, in a VANET environment, all the nodes are vehicles, they can move at very high speeds, and the driver should follow the traffic regulations as well. Hence they cannot move at any directions arbitrarily, so for data transmission in a VANET environment, more things have to be considered.

2. Related Work

There are many types of routing protocols in MANET and VANET, they can be divided into different groups, but the most common way is to divide them into three groups. The first one is pro-active routing protocols, the second one is re-active routing protocols, and the last one is hybrid routing protocols. [3][4]

Pro-active Routing Protocols are also named as table driven protocols, their route discovery method is similar with the traditional routing protocols: each node should broadcast its route information periodically to exchange their route information with each other, and discover route actively. Each node maintains one or more routing tables which contains the route information of all the other nodes in the network. All the nodes should update their routing tables to maintain the knowledge of the whole network. This kind of routing protocol includes DSDV, GSR, HSR, STAR, MMWN, CGSR, OLSR, TBRPF, CEDAR, and etc.

Re-active Routing Protocols are also named as on-demand protocols. Opposite to the pro-active routing protocols, the re-active routing protocols do not maintain the routing information of all the other nodes. They only invoke the route discover function on demand when there is no route to the destination node, therefore

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the topology structure and the routing table are constructed when needed, this information may be only one small part of the whole topology structure information. These kind of routing protocols include DSRC, AODV, TORA, ROAM, LMR, ABR, SSA, RDMAR, LAR, ARA, FROP, CBRP, and etc.

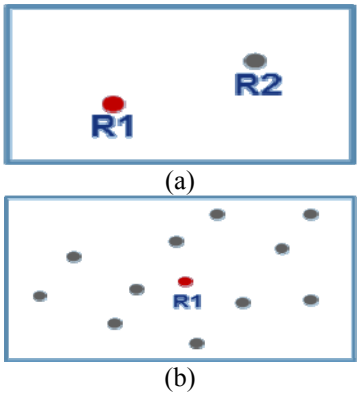
The class of hybrid routing protocols is a new type of routing protocols, it is the integration of the pro-active and re-active routing protocols essentially. These protocols allow some adjacent nodes to work together to form a kind of bone network aiming at reducing the cost of the route discovery, and enlarging the expansibility of the network. That is, some adjacent nodes maintain pro-active routing information while some remote nodes take the re-active routing method. Almost all the proposed re-active routing protocols are based on area identification. It means the network will be divided into several areas. This kind of routing protocol includes ZRP, ZHLS, SLURP, DST, DDR, and etc.

No matter which kind of protocol it is, almost all the protocols contain route discovery procedure, route maintenance procedure, and route repair procedure. [5][6][7] When the source node wants to transmit some data to the destination node, but the route does not exist, it should initiate the route discovery procedure to find one available route. Usually the source does this action by broadcasting RREQ messages. When the destination node receives this message, it responses with a RREP message to the source node. After the route was set up, if they want to keep this route information in their memory, and in order to keep their effectiveness for a given period of time, they should use the route maintenance procedure to update the route information. In many protocols, they use the hello message to notify the neighbour nodes of their new location and other information. When one node fails to receive any hello messages from the next hop neighbour node for a certain period of time, it will know the connection between them is broken now, and it can no more use this route for transmitting the data to the relative destination node. Then it tries to the route repair procedure, but if it fails to do this work, it gives a route disconnection warning message to notify the source node that the route to the destination node is broken now, and then the source node will come to the route discovery procedure again to discover a new route to that destination node.

As the above discussion, if a source node wants to transmit data to the destination node, it needs to establish a route firstly, no matter which kind of route algorithm it chooses, and then it can transmit data to the destination node. In this route establishment procedure, all the intermediate nodes between the source node and the destination node, even other unrelated neighbour nodes which won't join the real data transmit procedure, will have to take part in it, so it will cause the whole network to send and receive much more redundant data and will cause network congestion and data transmission delay. So we consider designing a data transmission algorithm that the source node can calculate the route by itself and fills the header of the data with the information of the whole route and directly send it to the next node.

3. Proposed Algorithm

In our last project, in order to provide more safety transport information to the driver in real time, we got the precise relative distance between each node and its neighbour nodes through some other algorithms, and in the next project procedure, we will calculate the relative position and build a node map of each node, as seeing itself as the centre of the map. Such as in the following figure, (a) means node R1 calculated the relative position of R2 and itself, (b) means node R1 builds the node map as seeing itself as the map centre.



(a)

(b)

Fig. 1: Node map establishment.

Let's assume that there are two nodes which are named as node A and node B, and node A wants to transmit some data to node B, then node A will discover the route to node B by itself without any other nodes participating:

Step 1: Check the direct distance from node A to node B.

Fig. 2: Direct distance checking.

In this step, node A will calculate the direct distance between B and itself, if it is less than 100m, it means they locate in each other's radio range, and they can communicate with each other directly, then node A will transmit the real data to B directly. If their distance is larger than 100m, it will come to step 2.

Step 2: Check the overlap area.

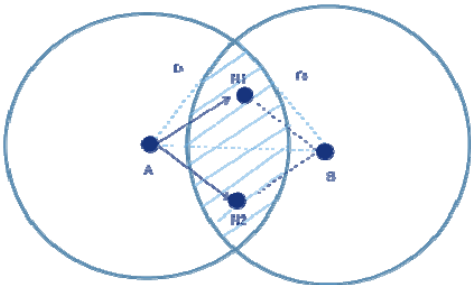


Fig. 3: Overlap area checking.

In this step, if the distance between node A and node B is larger than 100m, but smaller than 200m, it means that there exists an overlap area between them. In this situation, node A will draw two circles with seeing node B and itself as the circle center, and the radius is 200m, and these two circles will overlap with each other. Then node A will check whether there are any nodes in this overlap area, if it exists, it will select any one of them to be the intermediate node between node A and node B. Then, the route will be built as A—N1—B, or A—N2—B.

Step 3: Check the sector area.

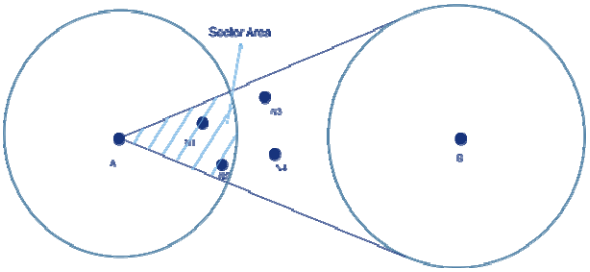


Fig. 4: Sector area checking.

In this step, node A will also draw two circles for both of node B and itself, then node A will draw two tangent lines with point A and circle B, such as in this figure, the marked area with oblique lines will be the sector area. Node A will then check whether there exists some nodes in this area, if there exist, it will select the farthest one as the next node, such as in this figure, node N2 will be selected. Then node A will come to step 1 to calculate the route between node N2 and node B. If there is no node locates in the sector area, it will come to the next step.

Step 4: Enlarge the sector area 10 degrees on both sides.

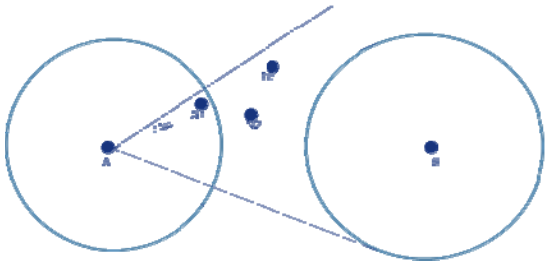


Fig. 5: Enlarge the sector area 10 degrees on both sides.

In this step, Node A will draw the sector area again by enlarging the original one 10 degrees on both sides, then it will do the similar work as in step 3 to check whether there are any nodes locate in the sector area, if exist, it will select the farthest one as the next node. If still not, it will enlarge the original sector area 20 degrees on both sides and check again. So in this step, node A will enlarge the sector area by 10 degrees each time until it will find any node locate in the sector area. If it still not exist any node until 360 degrees had been tried, it will fail to build the route to the destination.

After these 4 procedures, node A may finds the route to node B, then it will fulfill this route information into the data header of the real data, and transmit it to the next node directly. After receiving this data packet, the next node will extract the route information and check who the next-next node is, and transmit the data packet to that node directly, finally, until the destination receives the data packet.

4. Conclusion

In this paper, based on the other project's result, we proposed a new data transmit algorithm which has very few data communication process during the route establishment procedure to enhance the data transmit efficiency, and we will have a try to get a better simulation result to prove it in the following work.

5. Acknowledgements

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