An Efficient Grid Based Routing Scheme in Mobile Ad-hoc Networks

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1. Introduction

With the development of wireless communication technology and mobile devices, mobile users have increased rapidly. Mobile ad-hoc networks(MANETs) that consist of mobile nodes which communicate with each other through wireless links without network infrastructure have attracted a lot of attentions[1]. Various studies have been proposed to perform efficiently routing in MANETs[2, 3]. Recently, a grid based routing scheme using position information in MANETs has been proposed[4]. However, the existing scheme needs a head node in each zone, which results in high management cost. This is because each head node has to manage the other nodes in the same zone and new head nodes have to be selected when they leave the current zone. Therefore, we require techniques that can reduce the management cost of the head node selection, managing nodes, and route search and response procedures.

In this paper, we propose an efficient grid based routing scheme in mobile ad-hoc networks. In our proposed scheme, all nodes can be a candidate to forward messages to the specified destination node because head nodes do not exist. The proposed scheme reduce the message transmission for establishing a routing path using the node information of adjacent grid zone and establishes the optimal routing path by considering connectivity between a source node and a destination node.

2. The Proposed Grid-Based Routing Scheme

The proposed routing scheme assumes that a node knows its position information and the position information of a destination node. All nodes also maintain their neighbor nodes information on the table by the periodic update messages. Figure 1 shows the overall processing of the proposed routing scheme. The proposed scheme consists of three steps such as route search, route selection, and route recovery.

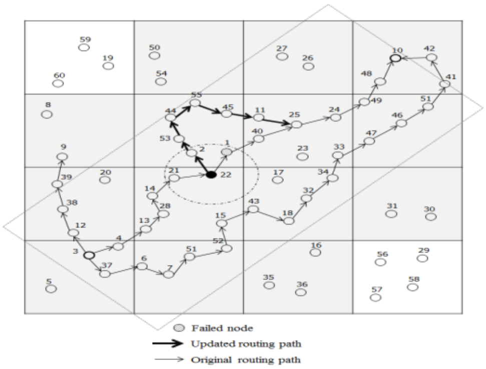

Figure 1. Overall process of the proposed routing scheme

In the route search step, a node sends a RREQ message to its neighbor nodes and a destination node by using their position information to establish a routing path. The route searching area and neighbor zone are considered when a node sends a RREQ message from a source node to a destination node. Each node sends the RREQ message to its neighbor nodes by considering the position information on its table and the destination node direction. During the route search, the number of messages is reduced because each node does not send RREQ message to all nodes with communication capability. Since the size of one grid area is larger than that of the transmission range of a node, the number of zones that need to be managed is small. The management cost of a head node does not occur because

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the proposed scheme does not use the head node.

In the route selection step, when a destination node receives a RREQ message from a source node, it selects an optimal routing path using route information included in the RREQ messages. And then it sends the RREP message that includes the selected routing path to the source node. The source node establishes the optimal routing path which sends data to the destination node by using node information with RREP messages. We consider connectivity and hop count when the destination node selects the routing path to send a real data. Route connectivity is the minimum connection time among the nodes of a routing path.

In the route recovery step, when a node cannot send data to the initial routing path, the alternative route is established. If any problem occurs in the node it searches the routing path to the destination node from its previous nodes using partial route updating again. Therefore, the proposed routing scheme is faster than existing methods.

3. Performance Evaluation

To show the superiority of the proposed scheme, we compare it with the existing scheme[4] in the same environments. We simulated the proposed scheme by using NS-2 network simulator. The simulation has modeled a network of 50-200 mobile nodes randomly placed in 700Ｘ700 meters area. Each node has radio propagation range of 40 meter and we set the grid edge length to be 100 meters. The average moving speed is set to 2m/s and each simulation runs for 1000 seconds.

To confirm efficient routing cost and connectivity, the total number of messages and delivery ratios according to the number of nodes in the network are compared. Figure 2 shows the total number of RREQ/RREP messages in the network. Figure 3 shows the delivery ratios according to the number of nodes in the network. As shown in figure 2 and figure 3, we can see easily that the number of messages and delivery ratios are increased with the increase of the number of nodes.

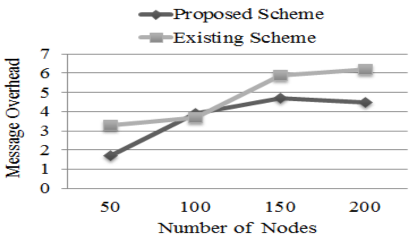

Figure 2. Message Overhead vs. Number of Nodes

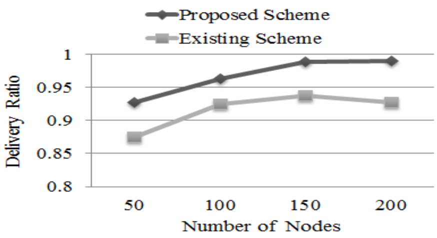

Figure 3. Delivery Ratio vs. Number of Nodes

As the results, it shows that the proposed scheme is better than the existing scheme. The proposed scheme reduces message overheads by about 22.5% and improves the delivery ratios by about 5.6% over the existing scheme on average.

4. Conclusion

In this paper, we proposed a new grid based routing scheme for reducing routing and management costs. Nodes establish the routing path by using the information of neighbor zones and route searching areas through their table information. Then, the destination node decides the optimal routing path based on available connection time among the nodes on the routing path. It was shown through performance evaluation that the proposed scheme reduces the routing cost and establishes the stable routing path over the existing scheme. In the future, we will perform various experiments in order to show the superiority of the proposed scheme in terms of mobility and topology.

5. References

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