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Position Based Routing Protocol with More Reliability in Mobile Ad Hoc Network

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***Abstract*—**Position based routing protocols are the kinds of routing protocols, which they use of nodes location information, instead of links information to routing. In position based routing protocols, it supposed that the packet source node has position information of itself and it's neighbors and packet destination node. Greedy is a very important position based routing protocol. In one of it's kinds, named MFR (Most Forward Within Radius), source node or packet forwarder node, sends packet to one of it's neighbors with most forward progress towards destination node (closest neighbor to destination). Using distance deciding metric in Greedy to forward packet to a neighbor node, is not suitable for all conditions. If closest neighbor to destination node, has high speed, in comparison with source node or intermediate packet forwarder node speed or has very low remained battery power, then packet loss probability is increased. Proposed strategy uses combination of metrics distance-velocity similarity-power, to deciding about giving the packet to which neighbor. Simulation results show that the proposed strategy has lower lost packets average than Greedy, so it has more reliability.

***Keywords*—**Mobile Ad Hoc Network, Position Based, Reliability, Routing.

I. Introduction

MOBILE ad hoc networks consist of wireless hosts that communicate with each other in the absence of a fixed infrastructure. They are used in disaster relief, conference and battlefield environments, and received significant attention in recent years [1,2,3]. The position based routing protocols are the kinds of routing protocols, which use nodes location information, instead of links information to routing. The routing decisions, are based on source node, neighbor nodes, destination node locations. Each node finds it's location by GPS or another positioning system. Each node periodically broadcasts it's location information by hello packets, to it's neighbors and then they will update their location tables. The source node finds the location of destination node, by a suitable location server. Position based routing protocols, have not routing tables overhead [4,5,6] The target is improving the position based routing protocols, with least overhead. Greedy is a very important position based routing protocol. In one of it's kinds, named MFR, source node or packet forwarder node, sends packet to one of it's neighbors with most forward progress towards destination node [7,8]. Using distance metric in Greedy is not suitable for all conditions. Proposed strategy increases Greedy reliability by using some other deciding metrics. The remainder of paper is organized as follows. Section II overviews Greedy protocol. Section III introduces the proposed strategy to improve Greedy method and increase it's reliability. Section IV presents simulation results to compare the strategies.

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II. Greedy Protocol

In greedy, packet sender node includes approximate position of the recipient in packet. This information is gathered by an appropriate location service. When an intermediate node receives a packet, it forwards packet to a neighbor lying in general direction of the recipient. Ideally, this process can be repeated until the recipient has been reached. Generally, there are different strategies that a node can use to deciding about, to which neighbor a given packet should be forwarded. In Fig. 1, S and D denote the source and destination (recipient) nodes of packet. The circle with radius *r* indicates maximum transmission range of S.

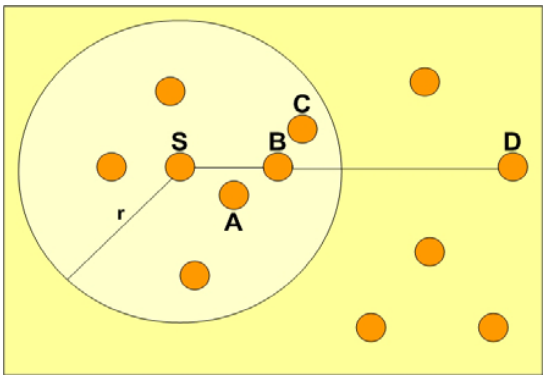

Fig. 1 Greedy protocol

One strategy is forwarding packet to closest neighbor to destination D. by using this strategy, node S sends packet to node C. This strategy is known as MFR, it tries to minimize the number of hops a packet has to traverse in order to reach D. In another strategy named NFP (Nearest with Forward Progress), packet sender node, sends packet to it's nearest neighbor node (it's closest neighbor with forward progress towards destination node). In Fig. 1, by using this strategy, node S sends packet to node A [7,8,9,10,11]. In compass routing strategy, packet sender node sends packet to neighbor

closest to supposed straight line between sender and destination nodes, by using this strategy, node S sends packet to node B [12].

III. Proposed Scheme

Greedy (MFR) just attends to distance deciding factor, and it does not attend to nodes conditions. This metric is not suitable for all conditions. If neighbor with most forward progress towards destination node has high speed, in comparison with source node or intermediate packet forwarder node speed (See Fig. 2) or has very low remained battery power (See Fig. 3), then packet loss probability is increased. We can use other deciding metrics in addition to distance metric, to improve Greedy protocol and increase it's reliability, The metrics like power, velocity similarity. The proposed strategy introduces some new metrics to avoid loss of packets because of neighbors high speed or low remained battery power, It uses combination (trade off between) metrics distance-velocity similarity-power, to deciding about to which neighbor the given packet should be forwarded. In proposed strategy, the packet sender or forwarder node, selects some neighbor nodes which have forward progress towards destination node, and again selects some of them, which have more similar speeds to it's own speed (nodes with less speed difference with sender speed) and finally, selects one of them which has most remained battery power and sends packet to it. In Fig. 2, if the proposed strategy is used to forward packet, node S sends packet to node C.

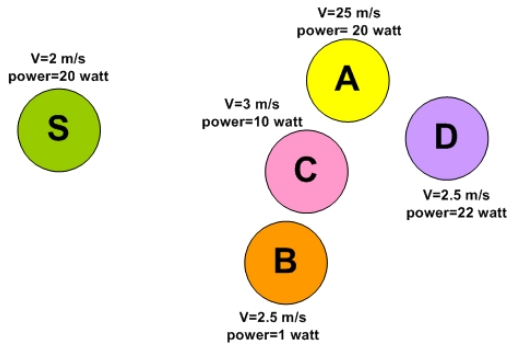

Fig. 2 Node (A) with most forward progress towards destination (D), has high speed in comparison with source node (S)

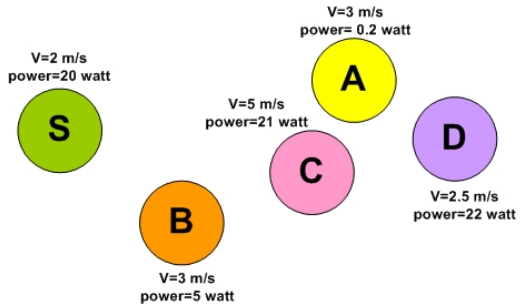

Fig. 3 Node (A) with most forward progress towards destination (D), has very low remained battery power

IV. Simulation Results

We implemented greedy and proposed strategy, with network simulator (NS2). There are ten mobile nodes, sender and destination nodes, and other are intermediate nodes. Simulation specifications are at below:

Channel: Wireless channel
Propagation Model: TwoRayGround
Mac: IEEE 802.11
Ifq: PriQueue
Ifqlen : 50
Ant: Omni Antenna
Simulation Duration: 150000
Ad Hoc Network Environment: 700×700 meters
Simulation Duration: 50 Seconds

In Real network, each node finds it's position by a positioning system like GPS, but in simulation we give every node, it's position without any expense. In real network and in simulation every node propagates it's position to it's neighbors, periodically. In real network, the packet source node finds the location of destination node by a suitable location server, but in simulation, we give position of destination node, to source node, without any expense. To simulate greedy (MFR), sender node calculates, the distance between it's neighbors and destination node , and sends packet to it's closest neighbor to destination node. To simulate the proposed strategy, sender node selects some (in this simulation, this number is 5) closer neighbor nodes to destination node, and again selects some (in this simulation, this number is 3) of them, which have more similar speeds to it's own speed (the nodes with less speed difference with sender node speed) and finally, selects one of them which has most remained battery power and sends packet to it. We define two scenarios, in first one, neighbor nodes have low speed, in comparison with source node or intermediate packet forwarder node speed. In second one, the neighbor nodes have high speed, in comparison with source node or the intermediate packet forwarder node speed. We simulated Greedy and proposed scheme and compared them by their packet delays and lost packets ratios.

A. The Strategies Packet Delay Comparison

The simulation results show that in first scenario, that neighbor nodes have low speed, both strategies packet delay are the same, because of methods similar structure (See Fig. 4). In second scenario, that neighbor nodes have high speed, Greedy protocol has less packet delay than it's packet delay in scenario1, because the lost packets of Greedy method in scenario 2 are increased (because of neighbors high speed). Because of lost packets, there will be less congestion and there are less packets, waiting in nodes queues, so received packets by destination node, have less delay (See Fig. 5).

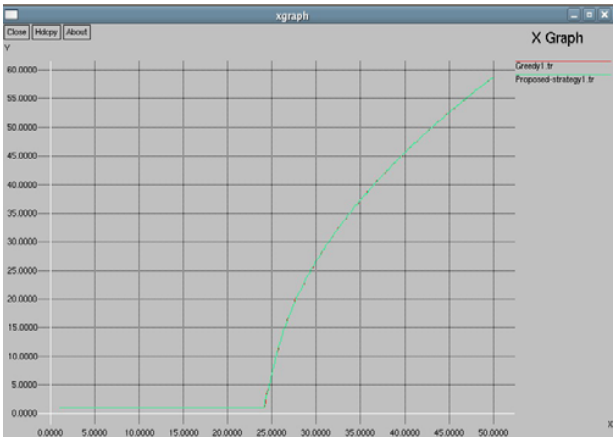

Fig. 4 Packet delay comparison between Greedy and proposed strategy, in scenario1. The X axis is time(s) and the Y axis is packet delay (ms)

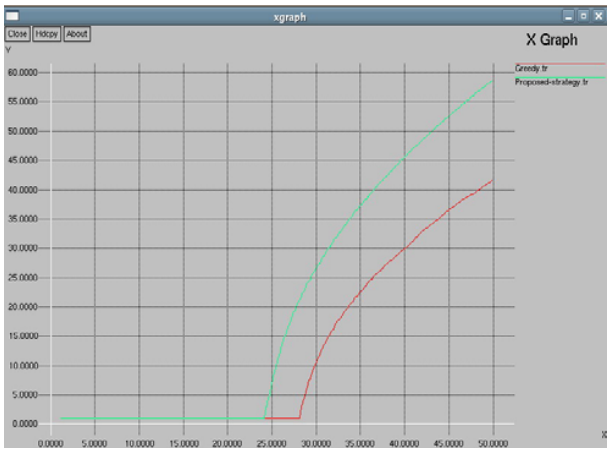

Fig. 5 Packet delay comparison between Greedy and proposed strategy, in scenario2. The X axis is time(s) and the Y axis is packet delay (ms)

B. The Strategies Lost Packets Average Comparison in Simulation Interval

Lost packets graphs of strategies in simulation interval, are in form of connected broken lines that we can't compare them easily (See Fig. 6). We can compare them by getting the average number, so we get the average of lost packets in lower intervals, and get the average of those average numbers. The lost packets average comparison of strategies in simulation interval, shows that in scenario1, that the neighbor nodes have low speed, the proposed strategy has lower lost packets average, than Greedy (See Fig. 7). In scenario 2, that the neighbor nodes have high speed, the proposed strategy has lower lost packets average than Greedy again, but the lost packets average difference between two strategies, is more than scenario1, because of neighbors high speed (See Fig. 8).

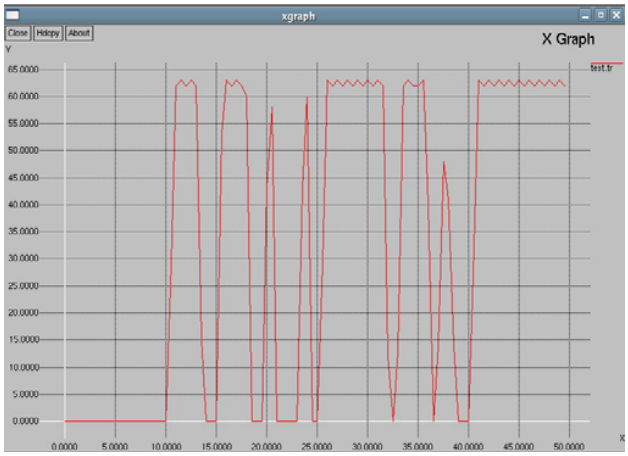

Fig. 6 An instance of lost packets ratio graphs in simulation interval. The X axis is time(s) and the Y axis is the number of lost packets in simulation interval.

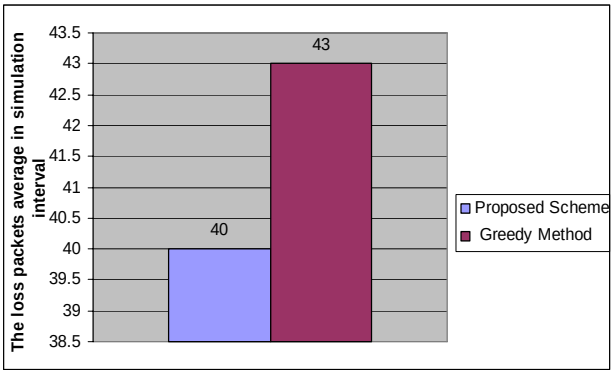

Fig. 7 Lost packets average comparison between Greedy and proposed strategy, in scenario 1

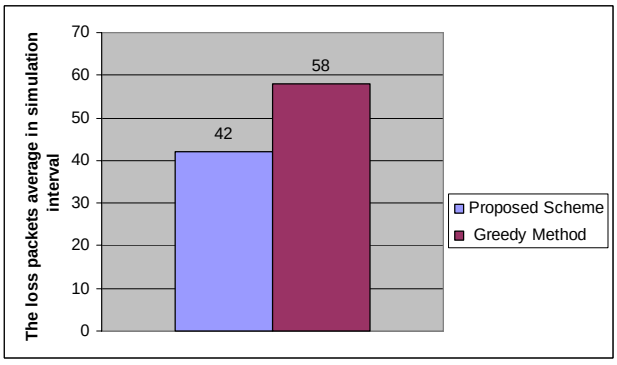

Fig. 8 Lost packets average comparison between Greedy and proposed strategy, in scenario 2

V. Conclusion

In this paper, we considered to a very important position based routing protocol, named Greedy. In one of it's kinds, named MFR, the source node or the intermediate packet forwarder node, sends packet to it's closest neighbor to destination node. Using distance deciding metric in Greedy, is not suitable for all conditions. If closest neighbor to

destination, has high speed (in comparison with source node or the intermediate packet forwarder node speed) or has very low remained battery power, then packet loss probability is increased. We can use other deciding metrics in addition to distance metric, to improve Greedy and increase it's reliability. The metrics like power, velocity similarity. The proposed strategy uses combination of (trade off between) metrics distance-velocity similarity-power, to deciding about to which neighbor, the given packet should be forwarded. The simulation results show that the proposed strategy has lower lost packets average than Greedy, so it has more reliability.

VI. Future Work

In future, we will work on the priority metric in addition to distance metric (Giving every node a priority number, for example giving higher priority numbers to nodes which cooperate more with other nodes, to forward packets), or we can use the security metric in environments with low security. Our target is to have a complete position based routing protocol, which works well in every situation.

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