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# Nearest Neighbor Detection Algorithm in Wireless Ad hoc Networks

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***Abstract— Discovering the nearest neighbor in wireless. The analysis is based on some of the practical problems of finding the nearest neighbor as the position of nodes keep changing in a wireless ad hoc network. Node mobility is one of the major in wireless ad hoc networks. This is resolved by Priority Position Optimal algorithm where the nearest neighbors act as a forwarding candidate with some criteria to denote the best forwarder.***

***Keywords—Forwarding candidate, Collision, Information base, neighbor discovery***

## I. INTRODUCTION

Wireless ad hoc networks have become more popular these days: The ability to interconnect wireless devices in various environments is one of the major reasons. Much effort has been spent on solving the routing challenge in such networks. In contrast, the links of an ad hoc network are often regarded invariant. In wireless networks, apart from other factors, the topology is determined by the transmission powers of the participating devices. Generally Ad hoc routing protocols make forwarding decisions based on geographical position of a packet's destination. Rather than destination node's position, each node has to know only its own position and the position of its neighbors to forward the packets. When the network is highly dynamic, position optimal priority routing can be used. In this method a sender can know the present position of the destination. There are basically two categories of approaches to topology control by the adjustment of transmission powers of network nodes. The first one tries to maintain a same power level for all nodes and the second one is individual node power. One possible way to solve nearest neighbor search is to construct a graph $G(V,E)$, where every point $x_i \in S$is uniquely associated with vertex $v_i \in V$. The search of the point in the set *S* closest to the query *q* takes the form of the search of vertex in the graph $G(V,E)$.One of the basic vertex search algorithms in graphs with metric objects is the greedy search algorithm. It starts from the random vertex $v_i \in V$. The algorithm computes a distance value from the query q to each vertex from the neighborhood $\{v_j : (v_i, v_j) \in E\}$of the current vertex $v_i$, and then selects a vertex with the minimal distance value. If the distance value between the query and the selected vertex is smaller than the one between the query and the current element, then the algorithm moves to the selected vertex, and it becomes new current vertex. The algorithm stops when it reaches a local minimum: a vertex whose neighborhood does not contain a vertex that is closer to the query than the vertex itself.

## II. SYSTEM MODEL

The architecture diagram of the proposed solution is depicted in Fig. 2.1.

Information Base keeps track of the new nodes as and when they joins the network. This happens during Node initialization and termination. The neighboring nodes are prioritized using the new proposed algorithm. The nearest neighbor is detected by the transmission power. If any of the neighbor goes down the next in priority is chosen as candidate for transmission until the destination is reached.

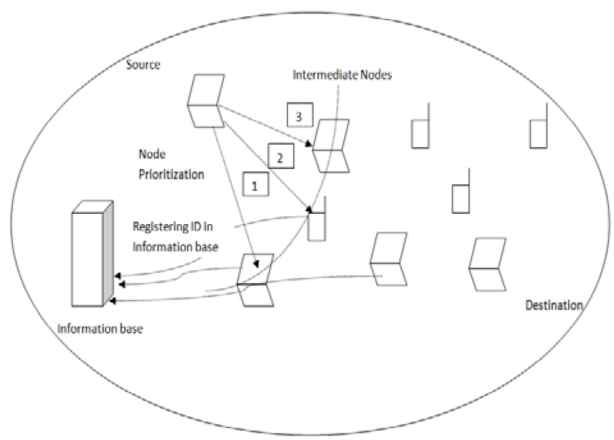


Fig. 2.1 Architecture Diargram

## III. PREVIOUS WORK

In some of the previous solution discovering the nearest neighbor was implemented in a single hop environment. For finding the appropriate neighbor some prioritization techniques has been used. Both the initialization and termination of the connection has been taken care in the previous research work. Asynchronous and synchronous methodology has been proposed with the collision detection strategy. These had a explanation of ALOHA-like algorithm and feedback-based algorithm.

Proposal on neighbor discovery was worked upon when nodes have multi-directional antennas. All those did not consider the practical problems of the wireless environment. As the nodes do not have the prior information about the other node it becomes far more difficult.

The upper bound and lower bound of the multi hop case was designed but the implementation was feasible. In this paper we are trying to present how the implementation in a multi hop environment will be feasible by the usage of the Information base. The block diagram below gives a basic structure of the problem.

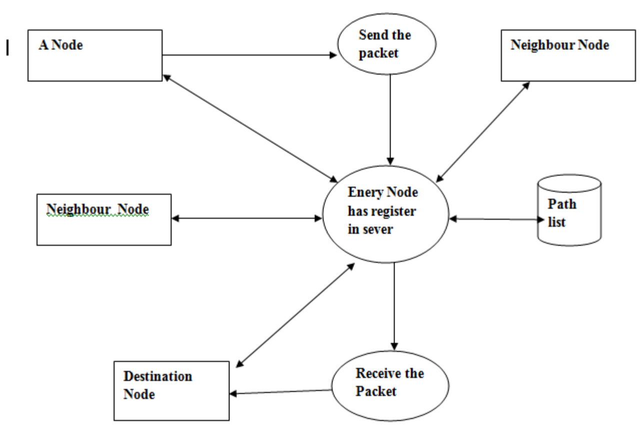


Fig 3.1 Data Flow in the system

## IV. PROPOSED METHODOLOGY

The modules of this implementation are divided into four functionalities explained in the below paragraphs from A to D.

### *A. Node Initialization/Termination:*

An active node enters the range of the network and broadcasts its unique ID. The central registry named as Information base captures the ID and stores it in its cache. If suppose the Information base registry is unavailable, the node resends the signal. After sending the initial signal, the node waits to get the nearest neighbor list. If it does not receive then it assumes either of the three: (1) Node itself has moved away from the network, (2) Information base is not reachable, (3) Collision happened for the previous transmission. In first case, node re-sends the packet and gets registered to the correct Information base register of the present network. In the second and third case, the node re-sends the signal again until it is registered. Information base register sends the nearest neighbor list which it stores in its cache.

Information registry sends periodic signal to the nodes to check its availability. If the node does not respond it is assumed to be unreachable and it is removed from the Information base.

### *B. Source/Destination Identification:*

Source sends out the transmission packet with the Destination ID to the nearest neighbors. Only the neighbor with highest priority unveils the header. All the other nodes are suppressed. Other neighbors are used as back-up when the highest priority node fails. Failure could be due to the following reasons: (1) Node power is switched off, (2) Node is moved away from the network. So, in such a failure the next prioritized node should resume back and participate in transmission.

On checking the header if it is the correct node to transfer the packet forward it does so else it discards the packet. It checks the destination ID and forward to the appropriate nearest neighbor from the information the node contains. This is how the node reaches the destination.

### *C. Nearest Neighbor Routing:*

The source forwards the packet to the nearest neighbor. At this point of time there is a checking on the current topology of the network. If the topology at t1 and t2 time-period is identical then Position Optimal Priority Routing method is followed else Multipath scheme is followed.

In Position Optimal Priority Routing method – Packet is sent each time to the nearest neighbor of highest priority and all others are suppressed. If the next node fails the packet is sent to appropriate forwarding candidate who keeps track of which way to forward in case of failure.

In Multi-path scheme – route discovery mechanism is used. First a statistical computation of the routes is performed.

Based on this statistics, the destination position is identified. Then the packet is sent to the destination.

### *D. Forwarding Candidate Selection:*

Each node prioritizes its nearest neighbor. This is done by calculating difference between the total outgoing and incoming packet. This helps to identify the most active nearest neighbor. This particular neighbor is given the highest priority and so on. So, in case of failure during Position Optimal Priority Routing the next highest priority node is selected as the forwarding candidate. The other neighbors are suppressed and so on.

Neighboring devices might refrain from increasing their transmission powers, because they have a sufficient number of links. Ultimately, a device located a little aside from the other devices might not have a single link, even though it uses maximum transmission power.

*Increasing the Neighbour Count –*

There are two reasons for a device *A* to detect that it has less than *k*min bidirectional links:

1) The transmission power of some of the devices in *A*'s communication range is too small. In this case, those devices (or at least some of them) need to increase their transmission power in order to establish a bidirectional link with *A*.

2) *A*'s own transmission power is too small to reach more devices. In this case, *A* must increase its transmission power in order to reach more devices.

*Decreasing the Neighbour Count –*

If a device detects that it has more than bidirectional links, it may nevertheless have to maintain its transmission power, since some neighbours may depend on these links. Reducing transmission power based solely on the own link count could cause neighbours to set their help flag, and consequently would again lead to an increase in transmission power. To prevent this oscillation, a station must broadcast the Information that it has more bidirectional links than needed. It does this by setting a satisfied flag. If a station detects that it has too many neighbors, it reduces its transmission power.

*Equations*

The density-based outlier detection algorithm is commonly used in anomaly detection. The outlier score is just the inverse of the density score of a point. The density is the inverse of the mean distance to the K-nearest neighbours of point p and is given by

$$\text{Density}(p,K) = \left( \frac{\sum_{y \in N(p,K)} d(p,y)}{|N(p,K)|} \right)^{-1}$$

((Incoming pkts - outgoing pkts)/incoming pkts)*100 = Node capacity

Higher the node capacity, higher will be the priority.

*Algorithm*

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Algorithm: Priority Position Optimal Algorithm

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Step 1: Device sends it ID to register in Information base.
Step 2: 802.11b card in the device to capture the transmission power.
Step 3: Compare transmission power of devices sending signal. Lower the transmission power nearer the device.
Step 4: Set the priority of the node. Nearest neighbor with highest priority.
Step 5: Update the priority in the information base.
Step 6: Node forward packet to the one with highest priority
Step 7: In case node fails, the packet is forwarded via the next priority node until it reaches destination.

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## V. SIMULATION RESULTS

The transmission power is kept at the minimal when the nodes are nearest to each other. This helps in improving the efficiency of the system. So we not only provide the transmission priority wise but also help in achieving efficiency. The graph in Fig 5.1 gives an idea on the overall transmission power against distance between the nodes.

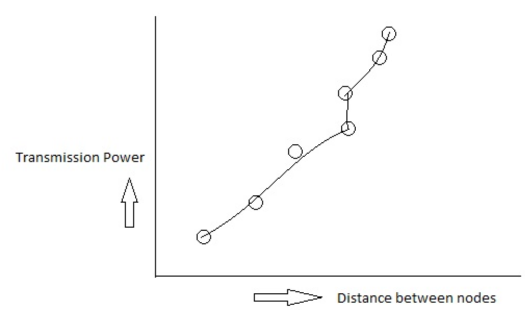


Fig. 5.1 Graph from Simulation

The simulation is done though a program unit developed using Java (JDK) where we are connecting multiple nodes.

A file from one node is selected and sends to the other. Transmission time is noted. It gives the frequency and hence the power of transmission.

TABLE 1

| S. No. | Transmission Parameters | Simulation | | Measurement | |
|---|---|---|---|---|---|
| | | $f_1$ | $f_2$ | $f_1$ | $f_2$ |
| 1. | Frequency(GHz) | 3.2 | 4.73 | 3.2 | 4.8 |
| 2. | Distance(mm) | 2 | 3.4 | 2.1 | 4 |

## VI. CONCLUSION

The algorithm based on prioritization and efficiency of the transmission power which can be implemented in a multi hop environment. The optimality depends on the shortest time the neighbor is detected and how faster the neighbor is detected. The implementation is done by simulation while in the real world a network set-up can be done to use this algorithm.

Assumptions had been made for having the supported softwares to be installed at each node to view the files. Any kind of documents and excels can be sent over the network. The transmission time does depend on the file format and the size.

## VII. FUTURE SCOPES

Battery backup problem has not been considered here. A new system can be developed by considering the battery power of each device. The same algorithm can be enhanced for transferring media files in a multi hop environment.

A system backup can be designed to choose the appropriate information base whenever the designated information base goes down or moves out of the range.

## REFERENCES

[1] K. Xu, M. Gerla, and S. Bae, “How effective is the IEEE 802.11 RTS/CTS handshake in ad hoc networks?” in Proc. IEEE Global Communications Conference (GLOBECOM), November 2002, pp. 72–77.

[2] H. Takagi and L. Kleinrock, “Optimal transmission ranges for randomly distributed packet radio terminals,” IEEE Transactions on Communications, vol. COM-32, no. 3, pp. 246–257, March 1984.

[3] R. Ramanathan and R. Rosales-Hain, “Topology control of multihop wireless networks using transmit power adjustment,” in Proc. IEEE INFOCOM, 2000, pp. 404–413.

[4] M. Kubisch, H. Karl, and A. Wolisz, “Distributed algorithms for transmission power control in wireless sensor networks,” in Proc. IEEE Wireless Communications and Networking Conference (WCNC’03), March 2003.

[5] D. Blough, M. Leoncini, G. Resta, and P. Santi, “The k-neigh protocol for symmetric topology control in ad hoc networks,” in Proc. 4th ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc’03), June 2003, pp. 141–152.

[6] L. Hu, “Topology control for multihop packet radio networks,” IEEE Transactions on Communications, vol. COM-41, no. 10, pp. 1474–1481, October 1993.

[7] V. Kawadia and P. R. Kumar, “Clustering and power control in ad hoc networks,” in Proc. IEEE INFOCOM, April 2003.

[8] S. Narayanaswamy, V. Kawadia, R. S. Sreenivas, and P. R. Kumar, “Power control in ad-hoc networks: Theory, architecture, algorithm and implementation of the compow protocol,” in Proc. European Wireless 2002 (EWC’02), February 2002, pp. 156–162.

[9] S.-J. Park and R. Sivakumar, “Load-sensitive transmission power control in wireless ad-hoc networks,” in Proc. IEEE Global Communications Conference (GLOBECOM), November 2002, pp. 42–46.

[10] N. Bambos, “Toward power-sensitive network architectures in wireless communications: Concepts, issues, and design aspects,” IEEE Personal Communications, pp. 50–59, June 1998.