OPEN ACCESS
Engineering Science & Technology Journal
Volume 2, Issue 1, P. 26-34, March, 2020
Fair East Publishers
Journal Homepage: www.fepbl.com/index.php/estj

LOCATION BASED PROTOCOL FOR WIRELESS NETWORKS

Asma Omar[1]
[1]Faculty of Engineering, The University of Nottingham, Malaysia

*Corresponding Author: Asma Omar
Article Received: 03-11-19 **Accepted:** 27-01-20 **Published:** 27-03-20

ABSTRACT

The current networks such as GPSR have its own limitations such as data transmission delay and node errors. To overcome such problems, new protocols are proposed in various studies. In current study, a location-based protocol for wireless network is proposed by using the MAC interception. The algorithm is such that if best possible node is not possible, the data can be transferred using the second-best possible node thus introducing the intermediary nodes as well in the model. Additionally, based on simulation, the results are compared for the performance of the proposed protocol with two other protocols. The results show that the proposed protocol perform better compare to the other protocols in terms of data transmission efficiency and reliability.
Keywords: Protocol, Location Based, Network, Wireless.

INTRODUCTION

In situation where fixed infrastructure is absent, mobile ad-hoc network can be used which works on the basis of wireless mobile nodes and function as a network. In mobile ad-hoc network**,** every single node in the network function as a router and able to identify the optimal path for sending the data packet. The use of mobile ad-hoc network is increasing in various commercial, industrial, and security-based organizations settings since it is convenient, economical, and inexpensive to setup. However, with these benefits, the limitations of the mobile ad-hoc network include energy constraints and the small bandwidth availability which is due to the reason that medium of communication is wireless.

The advantages of mobile ad-hoc network include infrastructure-less and multi-hop transmission which has leads to the increased usage of the mentioned network. However, because of the energy and wireless only based transmission, the network has its limitations and pose its own unique challenges. In this study, a new model of mobile ad-hoc network is proposed which uses intermediate nodes as air-backup and thus communication can be maintained without any disruption. This new proposed network is more efficient since here there are many nodes available which result in sending the data packet from sub-node in case of the non-availability of the best node. Thus, this type of system can be used in promoting the uninterrupted communication (Yang, Yeo, & Lee, 2011; Broch, Maltz, Johnson, Hu, and Jetcheva, 1998).

Location information is used for hop-by-hop data forwarding in geographic routing (Mauve, widmer, and Hartenstein, 2001). Greedy forwarding is used for selecting the next hop forwarder by avoiding the handling mechanism and by forwarding the data towards destination based on the largest positive progress. The greedy forwarding is more efficient since it provides no need for maintenance of end-to-end routes (Chen & Varshney, 2007). Accordingly, the next node which is comparatively at further distance from the sending node is selected in the next hop. However, the coverage can fail if the node is moved out from the coverage area. Another famous geographic routing protocol is GPSR which utilize the MAC-layer failure feedback for selecting the alternative route in case earlier transmission fails. In this system the issue is that with single transmission, there can arise situation of multiple reception and if this transmission is used as a backup, it can increase the system robustness. Opportunistic routing is an example where such type of system is successfully utilized (Chen & Varshney, 2007; Son, Helmy, & Krishnamachari, 2004). A further improvement in this system is the use of location-aided opportunistic routing which use information about the location for data transmission. The limitation of this system is that it is only capable of handling network throughput and designed for mesh network.

Keeping in view the above limitations, a new location-based opportunistic routing protocol is designed which uses the multiple forwarding cache for data transmission utilizing the MAC interception. In this proposed network, in situation where best forwarder node is not available, the second-best possible node will come forward and thus interruption will not occur. For data transmission, there will be different multipaths available which can be utilized accordingly. This system is thus possessing greater efficiency and robustness compare to the previous models.

In multiple settings, the use of geographic routing is increasing gradually. The geographic routing utilizes the network localization algorithms or global positioning system for providing information to each node about its geography resulting in smooth broadcast of data to nodes. The location of source node predicts the decision about next relay node and ultimate targeted position. Usually, larger networks utilize the geographic routing.

The next main routing is the greedy perimeter stateless routing or GPSR. It is one of the pioneering geographical routing-based protocol (Karp & Kung, 2000). For routing message, the system uses a forwarding strategy based on perimeters. Node's identity and position is submitted by neighboring beacons. All forwarded messages are piggybacked by the system. The algorithm works like this that the system attempts to identify the closest node based on forwarding node and the targeted node. Perimeter is introduced in GPRS as it avoids the problem of lack of uniformity among the nodes. This approach is based on right-hand graph traversal rule. There are fixed number of retransmits for every packet sent 8. A medium access layer provides this critical information to the nodes based on a standard. This bring limitation to the GPSR protocol as in situations where it is not able to submit based on perimeter mode.

The other important concept is AOMDV which utilizes the hop-by-hop approach and is based on distance vector concept. Route discovery procedure is used in AOMDV. Accordingly, it from source to destination is decided based on several reverse paths. From source and intermediate nodes, multiple forward and reverse path are identified. The route discovery frequency is minimized by using the intermediary nodes. The central idea in this protocol is that it ensures identification of disjoint and loop-free paths. AOMDV maintain loop-freedom, use local nodes, and update rules (Karp & Kung, 2000, Biswas & Morris, 2005).

The main problem this study is investigating is that there is various protocol which are inefficient in some situations such as larger network context. The main problem in such protocol is that route is pre-determined in advance to the data transmission. However, because of rapid changes in network topology, deterministic route is difficult to maintain. The problem also exists related to the procedures related to the discovery and recovery. In deterministic routes, the data is stuck or lost if the path is broken. The predetermination also causes larger energy consumption due to the discovery and recovery of the routes for data transmission. Thus, a routing protocol is required which overcome such problems and make use of location information for high quality and efficient data transmission. In this study, a proposed network protocol is produced which overcome the problems and provide an optimum solution.

Location Based Protocol

This proposed protocol is based on the idea of opportunistic forwarding and geographic routing. The design is based on information available to nodes regarding their own location and neighbors. Piggyback or one-hop beacon can be used for sharing neighborhood location information. Accordingly, the lookup service and location registration information is available to nodes. To make system more efficient, low bit data can be used for sending the location related information. In next, in situation where source node is starting data transmission, it will first determine the destination and then send the packet header. Additional check for the destination node is introduced for ensuring the delivery at the right node. The forwarding node will compare the details of destination node and neighboring nodes for ensuring the data transmission in the right range. This additional step is used for preventing the problem of path divergence. Mostly, the traditional systems use the MAC protocol or the integration of routing protocol for making a packet delivered to multiple nodes. Both systems have their own limitations such as lack of collision support and requirements of complex coordination. The alternative protocol proposed, a scheme similar to the MAC multicast mode is used which means data is broadcast as unicast in IP layer and multiple reception is achieved by utilizing the relevant interception. Thus, reduction in collision is possible by making use of RTS. Accordingly, the neighboring nodes of the sender node can do the eavesdrop on packet successfully having higher chances associated with medium reservation. Each data packet has its own unique identification in the form of unique tuple (src_ip, Seq_no) where the earlier one refers to the IP address and the later one is the associated sequence number. If a node receives a same data packet, it can identify it based on its unique ID and discard it immediately.

Redundancy can be used for improving the system's robustness. Currently, there are two classifications related to the MANETs based on their degree of redundancy. First one is based on hop-by-hop redundancy and the other one is the end-to-end redundancy. The proposed scheme in this paper is based on the hop-by-hop redundancy category.

If there are multiple paths between source and destination, it is referred as multipath routing and is used for improvement of the data transmission reliability. Currently, there are three types of multiple routing protocols. The first one uses packet replication over the multiple path. The second one uses the alternative paths as backup. The third one uses the split multipath delivery method. Practically speaking, it is not easy to locate suitable number of alternative paths.

For improving the wireless communication, wireless broadcast use is on the rise. The opportunistic forwarding is also utilized in the wireless communication for bringing improvement in the data transmission quality and reliability. By utilization of opportunistic forwarding, connectivity over the infrastructure network can be significantly improved. For overcoming the problems related to the wireless channel, opportunistic retransmission protocol is made available. The system is implemented at link layer and it select and prioritize relay nodes. By using smaller contention widow size and higher priority relay, the system improves the chances of successful packet delivery to its intended destination. The system also based on actual base station and auxiliary base station which significantly improves the performance of the data transmission. Our proposed system uses the traditional ad hoc routing for establishment of targeted path while the function of nearby node is to work as a guard node. The guard nodes function is to relay the data with prioritized back off time in situation where actual targeted nodes is failing. A limitation of this solution is that the final result may be selection of suboptimal paths compare to the highest optimal one which is compromise between efficiency and reliability.

RESULTS

Simulation is performed to make comparison between the proposed location-based protocol and the various mobile network topologies while making comparison with GPSR and AOMDV. The results are provided in this section.

The protocol is MAC based on IEEE 802.11. the two-ray ground is used for propagation model. The range for transmission is 300 m. Random way point is the mobility model and constant bite rate is the traffic type. The packet size is 256 bytes. In total there are 100 nodes and the simulation time is 400 seconds.

For performance comparison, we used the model nodes mobility for bringing improvement in random way point. The minimum node speed is 2 m/s and maximum speed is set as variable.

The important results are as follows;

Packet Delivery Ratio

Table 1: Packet Delivery Ratio

Number of Nodes	Packet Delivery Ratio LBP	GPSR	AOMDV
10	90	85	80
20	85	80	80
30	75	70	70
40	70	70	60
50	60	50	45
60	55	50	40
70	45	40	40
80	40	40	35
90	35	30	30
100	30	25	25

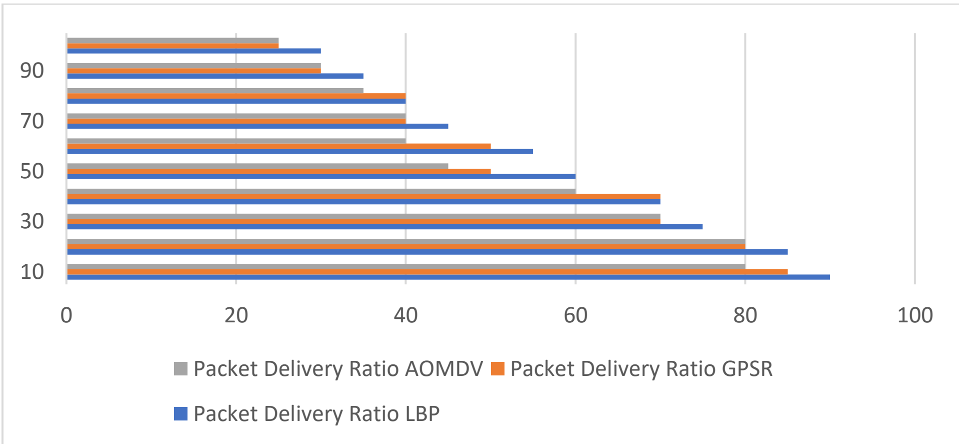

Figure 1: Packet Delivery Ratio

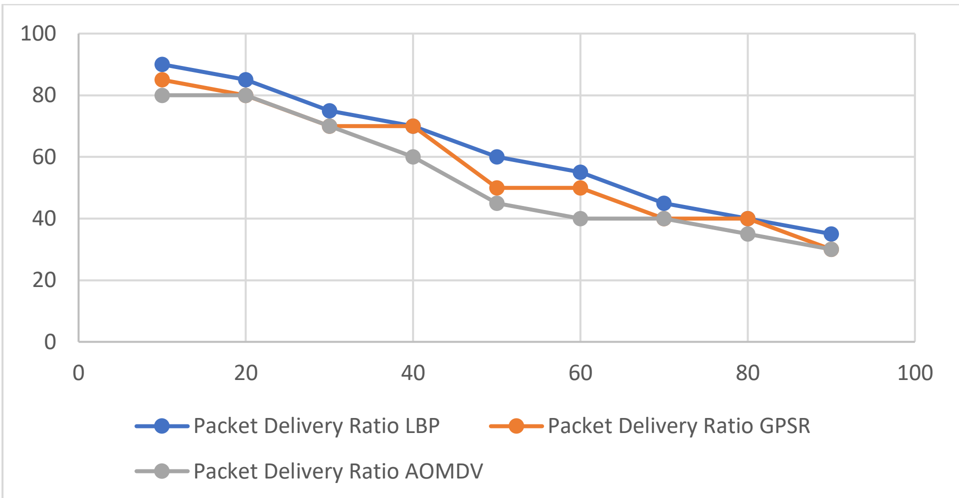

Figure 2: Packet Delivery Ratio Percentage

For packet delivery ratio, the location-based protocol performed better than GPSR and AOMDV. Accordingly, at 10 number of nodes, the LBP was 90, GPSR was 85, and AOMDV was 80. At 20 number of nodes, the LPO was 85, the GPSR was 80 and the AOMDV was 80. At 30 number of nodes, the LPO was 75, the GPSR was 70 and the AOMDV was 70. At 40 number of nodes, the LPO was 70, the GPSR was 70 and the AOMDV was 60. At 50 number of nodes, the LPO was 60, the GPSR was 50 and the AOMDV was 45. At 60 number of nodes, the LPO was 55, the GPSR was 50 and the AOMDV was 40. At 70 number of nodes, the LPO was 45, the GPSR was 40 and the AOMDV was 40. At 80 number of nodes, the LPO was 40, the GPSR was 40 and the AOMDV was 35. At 90 number of nodes, the LPO was 35, the GPSR was 30 and the AOMDV was 30. At 100 number of nodes, the LPO was 30, the GPSR was 25 and the AOMDV was 25.

Table 2: Throughput Analysis

	Throughput (Kbps)		
Number of Nodes	**LBP**	**GPSR**	**AOMDV**
10	40	40	45
20	90	85	70
30	120	110	110
40	120	130	130
50	250	240	230
60	350	330	320
70	400	380	370
80	550	450	430
90	700	650	600
100	1050	900	950

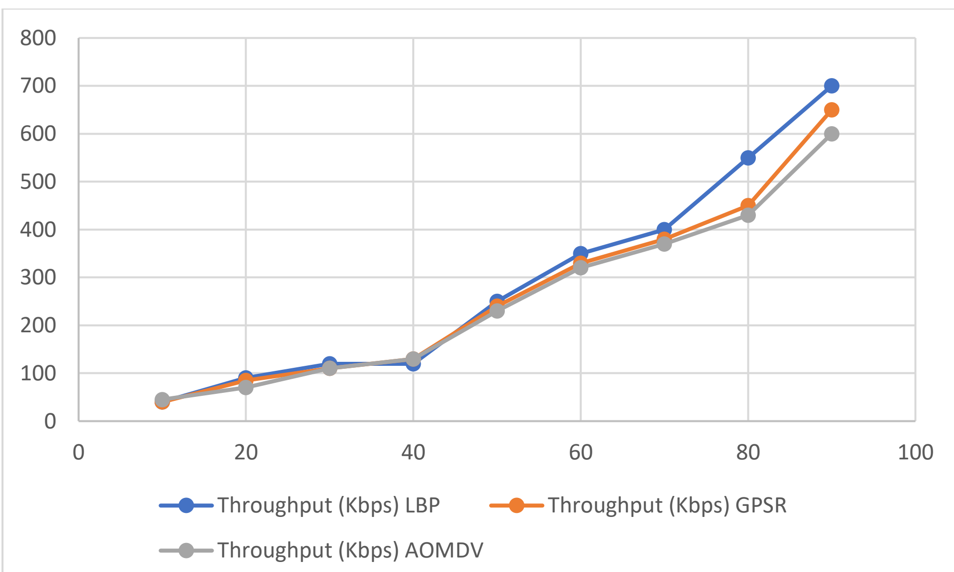

Figure 3: Throughput

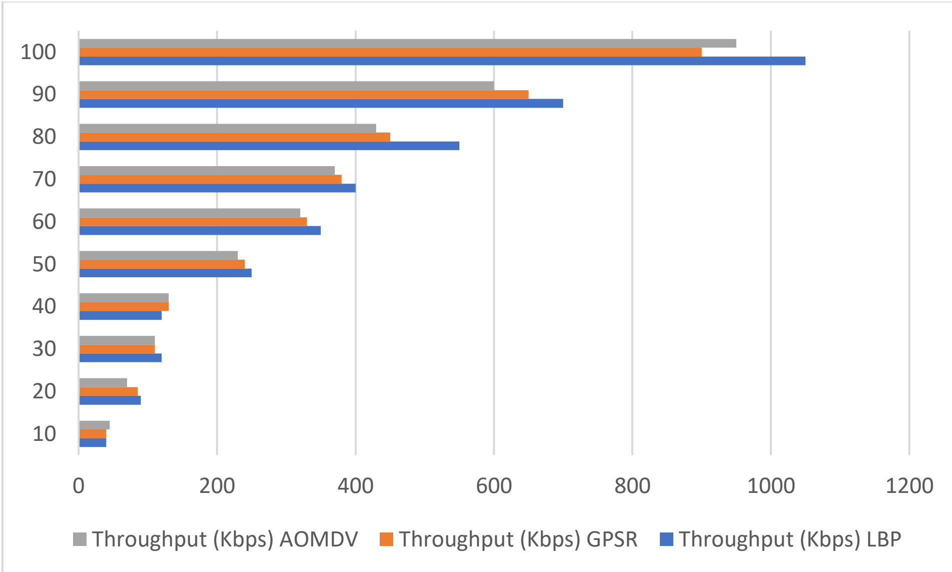

Figure 4: Throughput Ratio

For throughput in Kbps, the results are provided in the above table and charts. Accordingly, at 10 number of nodes, the LBP was 40, GPSR was 40, and AOMDV was 45. At 20 number of nodes, the LPO was 90, the GPSR was 85 and the AOMDV was 70. At 30 number of nodes, the LPO was 120, the GPSR was 110 and the AOMDV was 110. At 40 number of nodes, the LPO was 120, the GPSR was 130 and the AOMDV was 130. At 50 number of nodes, the LPO was 250, the GPSR was 240 and the AOMDV was 230. At 60 number of nodes, the LPO was 350, the GPSR was 330 and the AOMDV was 320. At 70 number of nodes, the LPO was 400, the GPSR was 380 and the AOMDV was 370. At 80 number of nodes, the LPO was 550, the GPSR was 450 and the AOMDV was 430. At 90 number of nodes, the LPO was 700, the GPSR was 650 and the AOMDV was 600. At 100 number of nodes, the LPO was 1050, the GPSR was 900 and the AOMDV was 950.

Table 3: End to End Delay

Number of Nodes	End to End Delay		
	LBP	**GPSR**	**AOMDV**
10	10	15	15
20	25	30	30
30	35	40	45
40	55	60	60
50	60	70	75
60	80	90	100
70	110	130	140
80	120	130	150
90	150	180	180
100	160	190	200

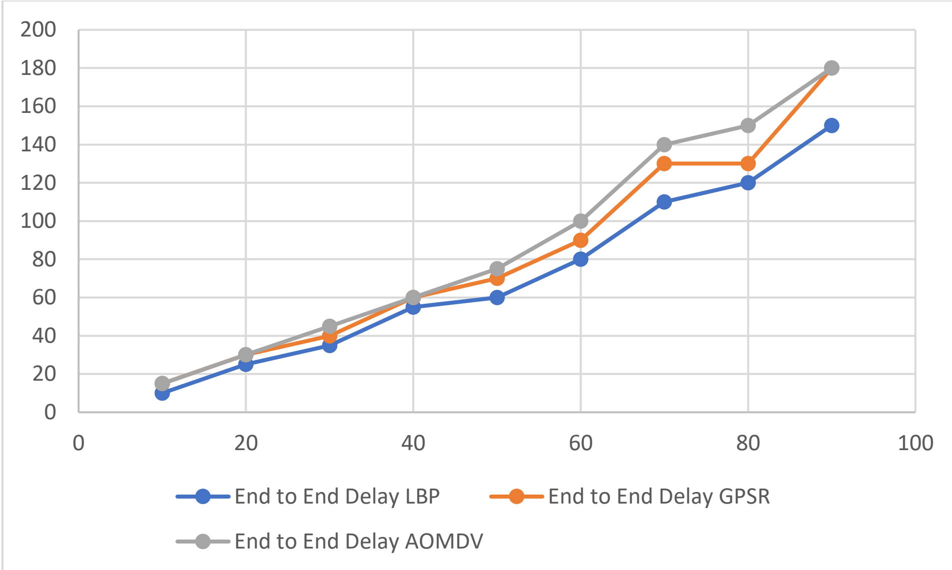

Figure 5: End to End Delay

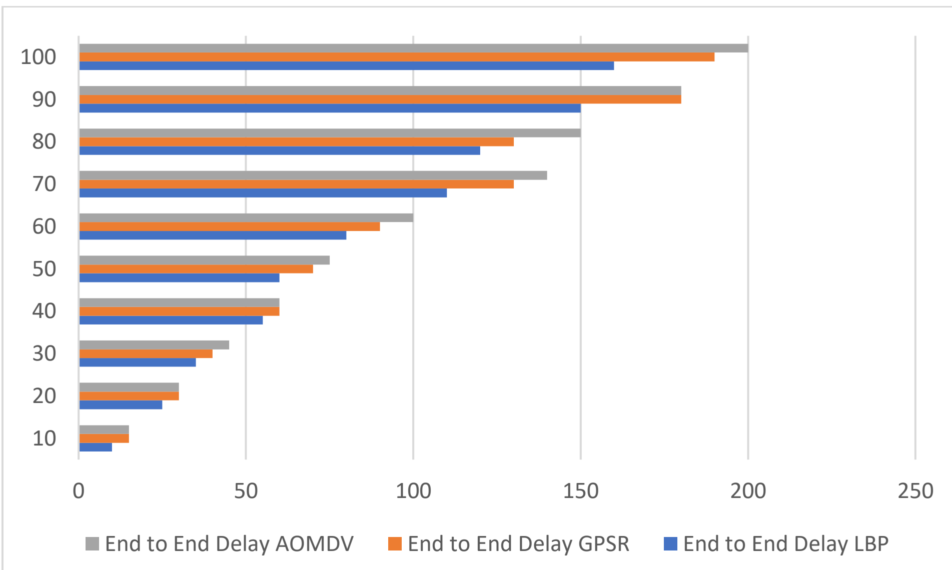

Figure 6: End to End Delay Percentage

The results for end to end delay shows that at 10 number of nodes, the LBP was 10, GPSR was 15, and AOMDV was 15. At 20 number of nodes, the LPO was 25, the GPSR was 30 and the AOMDV was 30. At 30 number of nodes, the LPO was 35, the GPSR was 40 and the AOMDV was 45. At 40 number of nodes, the LPO was 55, the GPSR was 60 and the AOMDV was 60. At 50 number of nodes, the LPO was 60, the GPSR was 70 and the AOMDV was 75. At 60 number of nodes, the LPO was 80, the GPSR was 90 and the AOMDV was 100. At 70 number of nodes, the LPO was 110, the GPSR was 130 and the AOMDV was 140. At 80 number of nodes, the LPO was 120, the GPSR was 130 and the AOMDV was 150. At 90 number of nodes, the LPO was 150, the GPSR was 180 and the AOMDV was 180. At 100 number of nodes, the LPO was 160, the GPSR was 190 and the AOMDV was 200.

CONCLUSION

The purpose of the study was to propose a location-based protocol for overcoming the problems related to the earlier versions of the protocols. The location-based protocol proposed in the study is based on hop-to-hop opportunistic routing approach. The approach is based on wireless medium network and for geographic routing. The simulation was performed for making comparison between the proposed network and the GPSR and AOMDV. The results based on the packet delivery, throughput, and end-to-end delivery, shows that the proposed protocol shows better results comparison to the GPSR and AOMDV.

References

Biswas, S., & Morris, R. (2005, August). ExOR: opportunistic multi-hop routing for wireless networks. In *Proceedings of the 2005 conference on Applications, technologies, architectures, and protocols for computer communications* (pp. 133-144).

Broch, J., Maltz, D. A., Johnson, D. B., Hu, Y. C., & Jetcheva, J. (1998, October). A performance comparison of multi-hop wireless ad hoc network routing protocols. In *Proceedings of the 4th annual ACM/IEEE international conference on Mobile computing and networking* (pp. 85-97).

Chen, D., & Varshney, P. K. (2007). A survey of void handling techniques for geographic routing in wireless networks. *IEEE Communications Surveys & Tutorials*, *9*(1), 50-67.

Karp, B., & Kung, H. T. (2000, August). GPSR: Greedy perimeter stateless routing for wireless networks. In *Proceedings of the 6th annual international conference on Mobile computing and networking* (pp. 243-254).

Karp, B., & Kung, H. T. (2000, August). GPSR: Greedy perimeter stateless routing for wireless networks. In *Proceedings of the 6th annual international conference on Mobile computing and networking* (pp. 243-254).

Mauve, M., Widmer, J., & Hartenstein, H. (2001). A survey on position-based routing in mobile ad hoc networks. *IEEE network*, *15*(6), 30-39.

Son, D., Helmy, A., & Krishnamachari, B. (2004). The effect of mobility-induced location errors on geographic routing in mobile ad hoc sensor networks: analysis and improvement using mobility prediction. *IEEE Transactions on mobile computing*, *3*(3), 233-245.

Yang, S., Yeo, C. K., & Lee, B. S. (2011). Toward reliable data delivery for highly dynamic mobile ad hoc networks. *IEEE transactions on mobile computing*, *11*(1), 111-124.