

Performance Improvement in Conventional AODV Using Energy Efficient Manifold Route Discovery Scheme

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Abstract: The decentralized network formed without any assistance of the fixed infrastructure and just by the employing the volunteering mobile or the portable devices that work in a cooperative manner along with the other devices that are clubbed in the network are inbuilt with the capacity of providing a best data conveyance facility utilizing the unicast, multicast and the broadcast methods of the routing strategies. Despite the capabilities of these type of networks, it faces difficulties in devising a strategy of routing according to the dynamic nature of the distributed network. The reactive type or the on demand routing are highly used over the proactive way of routing in the decentralized network as the performance of the former is better compared to the latter. As the mobile device employed are capable are moving from its position irrespective of time, and they behave as the route and as well as the end node or the initiating node. The important factors to be considered while forming the route is the power required for transmission and the current position of the nodes, this is quiet tedious. The study in the paper provides the importance of the on demand routing distance vector routing for the distributed network that are linked in a adhoc manner and analysis all the existing on demand distance vector routing strategies and form a new manifold route discovery scheme to improve the conventional_AODV. The method devised to improve the conventional_AODV proves to be efficient when simulated using the NS-3 on the basis of the packet delivery rate, load balancing and the energy usage.

Keywords: Decentralized Network, Dynamic Routing, Conventional_AODV, Manifold Route, Performance Improvement

1. Introduction

The introduction of the paper plainly speaks about the decentralized networks and the importance of the on demand distance vector routing in these kind of networks. In the decentralized network where the devices are linked in an adhoc manner, the adhoc routing strategies regulates and makes the decision on the means the data from the devices in the network are routed to the end systems. The distributed network forms a network on their own with the mobile devices that volunteer to form the network. The topology of the

network is remains undecided as the devices engaged are mobile in nature. So the routing must be adaptable to the dynamically changing positions of the network and must be capable enough to provide quick response to the changes in the topology of the network. Apart from this routing strategy by be efficient on the term of the data delivery, energy utilization and communication overhead etc. For this the routing has to properly maintain the route identified and must have the potential to discover another route, if the current route fails due to the displacement of the nodes.

Form the above discussion it is clear that the distributed networks formed using the mobile dives does not have any devices or routers that are fixed. The devices engaged in the routing acts as the system that starts up the communication as the end system the router etc. so the routing strategy has to consider the power required for the transmission also. So the basic operation of the routing strategy is to opt an accurate devices and the route enriched with the accurate devices, to perform a delivery of information without any loss, minimizing the power required in transmission and enhancing the longevity of the network reducing the link failures. The security for the data transmission is also an another criteria that has to be taken care off while routing as the path that is enriched with the accurate data point having the necessary energy are liable of being a malicious nodes. So it becomes essential that the routing strategy considers the secureness of the data.

The distributed network have several advantages over the conventional networks as these networks can be easily configured at an affordable cost and are tolerant against the faults as the oath are identified separately by the nodal points utilizing the other nodes in the middle as the relay nodes. The possible bottlenecks in the routing are reduced by the following a multi hop method. So the AODV type routing well suits these distributed networks formed using the mobile devices that move freely.

So the work carried out in the paper analysis the conventional_AODV and the other AODV methods available and propose a modification for the conventional_AODV to improve the performance of the conventional_AODV on the basis of the delivery, energy usage, load balancing and energy usage. The paper is arranged as follows with the literature survey of different ADOV routing in 2 the proposed modification in 3. The analysis in 4 and the conclusion in 5

2. Literature Survey

The adhoc on demand distance vector routing is a reactive routing method that forms the network only when there a requirement. The literature survey is about the review on the different types of AODV routing. The on demand routing are mostly preferred as they are framed according to the demand and reduce the traffic congestion and are highly effective. The following papers are the routing framed in the adhoc

network with the different types of on demand distance vector routing. The three main categories of the AODV is analyzed in the paper is AODV devised with load balancing, adaptability and the secureness.

Form the papers surveyed on the conventional_AODV the pros and the cons in the AODV were identified the table.1 below is about the pros and cons of the proposed method. Huang, Tsung-Chuan, et al devised the "AODV-based backup routing scheme in mobile ad hoc networks." Liu, et al [2] proposed an "An improvement of AODV protocol based on reliable delivery in mobile ad hoc networks." Medadian, et al [3] developed a "Combat with Black hole attack in AODV routing protocol in MANET." Ahn, Chang-Woo et al [4] put forth an A node-disjoint multipath routing protocol based on aodv in mobile ad hoc networks." Abdulai, J., Mohamed Ould-Khaoua et al [5], devised a method for. "Improving probabilistic route discovery in mobile ad hoc networks."

Pros	Cons
AODV significantly decreased the amount of network routing emails	Bandwidth overhead, as RREQ & RREP packets need a lot of data to validate a path.
Because the bandwidth is effective, less battery energy is consumed	If the intermediate node has not the recent destination sequence amount, stale entries may result
Its primary benefit is that only when one node raises a request to interact with another node are routes created.	Multiple RREP packets can result in big overhead control in reaction to a single RREQ packet.
To overcome the problem of counting to infinity, as in other vector routing protocols, AODV uses sequence numbers to find a fresh route to the destination	Hello messages add substantial overhead to the protocol.

Figure.1 Pros and Cons of Conventional_AODV

EffatParvar, et al [6] performed the "Load balancing and route stability in mobile ad hoc networks based on AODV protocol." Kim, Bong et al [7] conducted an "An ad-hoc routing protocol with minimum contention time and load balancing." Yuan, et al [8] put forth "an adaptive load-balancing approach for ad hoc networks." using the on demand Yoo et al [9] and [10] conducted a "simple load-balancing

approach in cheat-proof ad hoc networks and as well as to secure the adhoc network” the security enhancements in the AODV was proposed by the author Kurosawa, et al [11]

Smys, S., et al [12] put forth a "K-connection Maintenance algorithm for Balanced Routing in Mobile Ad Hoc Networks." to attain a balance in the routing by maintaining the k-connection. Wadbude, et al [13] conducts “an efficient secure AODV routing protocol in MANET.” Neelaveni, R. et al [14] has designed a routing for the vehicular network in the adhoc manner. Sathesh, A. et al [15] proposed an “Optimized Multi-Objective Routing for Wireless Communication with Load Balancing.”

3. Proposed Work

The proposed work in order to improve the performance of the conventional_AODV, modifies the AODV by combining the greedy perimeter stateless routing [16] with it. The method follows two types to forward the data

- (i) Greedy Forwarding
- (ii) Perimeter Forwarding

In greedy forwarding “the node acting as relay follows a greedy method in deciding the next hop relay node, it searches for the node far away from the source and closer to destination as the next hop to forward the packet the figure. 1 below depicts the greedy forwarding by avoiding he node x that is closer to source and farer from destination and uses the y node that is farer from the source and closer to the destination as the next forwarding node, this followed until the end node the destination is reached”.

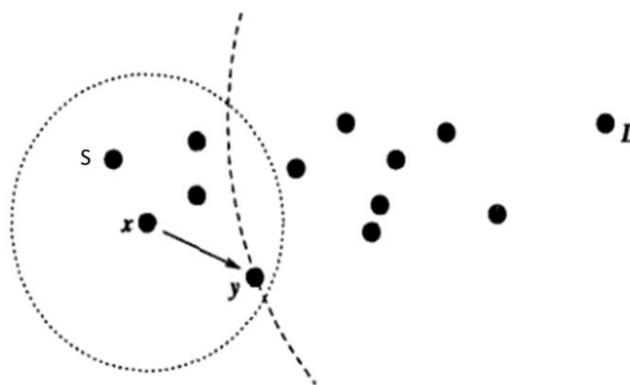


Figure.1 Greedy Forwarding

The figure.1 illustrates the greedy forwarding procedure the position of the nodes are observed by the “beaconing method”, the periodical beacon transmission with the details of the every node is done to the “broadcast MAC address” by this process the node that lies out of range are deleted nowadays the piggyback method instead of beaconing is used to send the information of the nodes. The greedy forwarding is used when proper topology is not maintained in the network Next procedure used in the GPSR is the perimeter forwarding. In this “a long right hand rule for the traversing a graph is used in the perimeter forwarding, according to the rule the data packet on reaching x from node y the next edge traversed is the next one sequentially counter clock wise about the ‘x’ and from the edge x,y ,it is known that the right hand rule traverses the interior of the closed polygonal region (a face) in clock wise edge order in the case, the triangle bounded by the edges between the nodes x,y,z in the order (y-x-z-y). The rule traverses an exterior region, in this case, the region outside the same triangle in the clock wise counter edge”

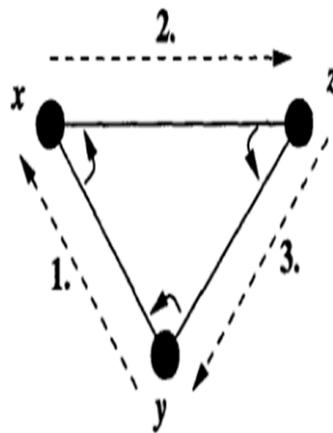


Figure.2 Right Hand Rule (Interior to Triangle)

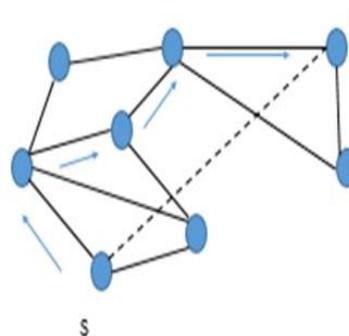


Figure.3 Perimeter Mode Forwarding

In order to use the “cycle traversing properties to route around voids. The traversing cycle amounts to navigate around the pictured void, specifically to nodes closer to the destination than x (including the destination) this sequence is termed as the edge traversed by the right-hand rule a perimeter. The packet type of the Greedy perimeter is displayed below in the figure .4

Field	D	LOC(P)	LOC (curr)	FE	PM
Function	Location of Destination	Packet in perimeter mode	Current location	First Edge	Packet Mode

Figure.4 Fields and Function of Packet Header

Every nodes has a table holding the details of the position and the next nearest neighbors who could be reached in one HOP. The packet mode indicates whether the discovery process is taking place in the perimeter or the greedy mode. In GM the nearest next hop node that is closer to the destination is sorted out, this continues until the destination is reached. In the PM the LOC (P) where the GM has failed is noted and utilized in the consequent strides to estimate whether the mode could be resumed to GM. The LOC (CURR) is noted down every time the packets are relayed to a different face. The D is shared across the preceding and the proceeding faces. The first edge is the position of the sender and the receiver this saves the edge address of the packet in the node the packet has crossed for the first time, this enables to avoid the duplication.

In PM the LOC (P) is compared with the location of the relay node and returns packet to the GM if depth of relay node to D < LOC (P) to D. The PM is done to make progress from the local maximum. The packets are relayed using the right hand rule. The figure.3 is about the perimeter type forwarding.

This is clubbed with the Conventional_AODV and the performance is analyzed. The routing mode of GPSR enables to identify an alternate route at a reduce time as it is framed to sort out the nearest nodes in the network where a fixed topology is not followed. This enhances the performance of the Conventional_AODV, in terms of data transmission, and the delivery. The results section analyzing the process using the NS-3 enables one to know the performance improvement achieved in the common AODV.

4. Result Analysis

The tabe.2 below displays the parameter used in the simulation process, the simulation is done using the NS-3 and the performance improvement achieved is observed and compared with the other state of art

methods such as Conventional-AODV (C-AODV), Load balancing AODV (L-AODV) and Adaptive_AODV (A_AODV).

Parameters	Values
Routing Protocols	C-AODV, L-AODV,A_AODV, Proposed
Wireless Channel	802.11
Topology	Grid
Node Distance	100
Mobility Model	Random direction 2D model
Number of Nodes	10-200
Communication	Point to Point

Table.2 Simulation Parameters

The figure. 5 depicts the number of packets transmitted over seconds using the each method. For the number of nodes varying from 10 to 200, the results was observed under different circumstances and the proposed routing proved to provide a better performance for the distributed network than the other three.

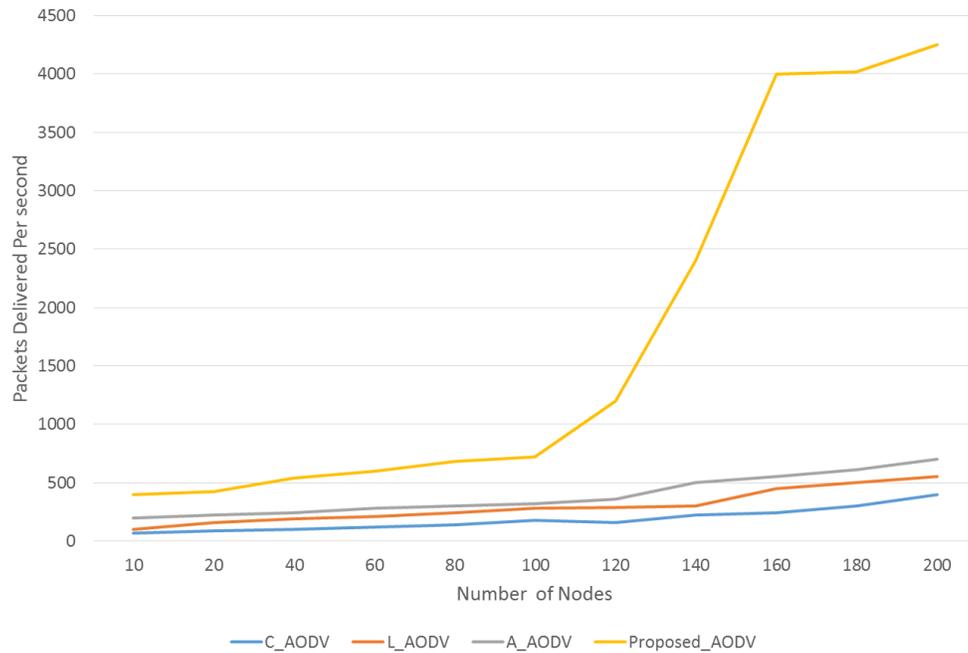


Figure.5 Packets Delivered

The table.1 shows the energy usage in joules observed for all the methods for different number ranging from 10 to 200,

Number of nodes	C_AODV (joules)	L_AODV (joules)	A_AODV (joules)	Proposed_AODV(joules)
10	75	67	56	20
20	87	69	67	24
40	79	76	70	18
80	80	78	76	29
160	83	80	79	30
200	85	82	79	32

Table.3 Energy Utilized

The results prove the performance of the proposed was better compared to the prevailing methods on the basis of energy usage.

5. Conclusion

The paper studies the different AODV methods and put forward a modification in the C_AODV by clubbing the GPSR with it and forms a manifold route discovery strategy using the greedy and the perimeter forwarding to provide a performance up gradation in the C_AODV. The results ensure that the performance of the C_AODV is enhanced by clubbing the GPSR with it. The security measure in safeguarding data through the proposed method is to be proceeded in the future.

References

- [1] Huang, Tsung-Chuan, Sheng-Yu Huang, and Lung Tang. "AODV-based backup routing scheme in mobile ad hoc networks." In 2010 International Conference on Communications and Mobile Computing, vol. 3, pp. 254-258. IEEE, 2010.
- [2] Liu, Jian, and Fang-min Li. "An improvement of AODV protocol based on reliable delivery in mobile ad hoc networks." In 2009 Fifth International Conference on Information Assurance and Security, vol. 1, pp. 507-510. IEEE, 2009.
- [3] Medadian, Mehdi, Mohammad Hossein Yektaie, and Amir Masoud Rahmani. "Combat with Black hole attack in AODV routing protocol in MANET." In *2009 First Asian Himalayas International Conference on Internet*, pp. 1-5. IEEE, 2009.
- [4] Ahn, Chang-Woo, Sang-Hwa Chung, Tae-Hun Kim, and Su-Young Kang. "A node-disjoint multipath routing protocol based on aodv in mobile ad hoc networks." In 2010 Seventh International Conference on Information Technology: New Generations, pp. 828-833. IEEE, 2010.
- [5] Abdulai, J., Mohamed Ould-Khaoua, and Lewis M. Mackenzie. "Improving probabilistic route discovery in mobile ad hoc networks." In 32nd IEEE Conference on Local Computer Networks (LCN 2007), pp. 739-746. IEEE, 2007.
- [6] EffatParvar, Mehdi, MohammadReza EffatParvar, Amir Darehshoorzadeh, Mehdi Zarei, and Nasser Yazdani. "Load balancing and route stability in mobile ad hoc networks based on AODV protocol." In 2010 International Conference on Electronic Devices, Systems and Applications, pp. 258-263. IEEE, 2010.
- [7] Kim, Bong Chan, Jae Young Lee, Hwang Soo Lee, and Joong Soo Ma. "An ad-hoc routing protocol with minimum contention time and load balancing." In GLOBECOM'03. IEEE Global Telecommunications Conference (IEEE Cat. No. 03CH37489), vol. 1, pp. 81-85. IEEE, 2003.

- [8] Yuan, YuHua, Huimin Chen, and Min Jia. "An adaptive load-balancing approach for ad hoc networks." In Proceedings. 2005 International Conference on Wireless Communications, Networking and Mobile Computing, 2005., vol. 2, pp. 743-746. IEEE, 2005.
- [9] Yoo, Younghwan, and Sanghyun Ahn. "A simple load-balancing approach in cheat-proof ad hoc networks." In *IEEE Global Telecommunications Conference, 2004. GLOBECOM'04.*, vol. 6, pp. 3573-3577. IEEE, 2004.
- [10] Yoo, Younghwan, and Sanghyun Ahn. "A simple load-balancing approach in secure ad hoc networks." In *International Conference on Information Networking*, pp. 44-53. Springer, Berlin, Heidelberg, 2004.
- [11] Kurosawa, Satoshi, Hidehisa Nakayama, Nei Kato, Abbas Jamalipour, and Yoshiaki Nemoto. "Detecting blackhole attack on AODV-based mobile ad hoc networks by dynamic learning method." *IJ Network Security* 5, no. 3 (2007): 338-346.
- [12] Smys, S., and G. Josemin Bala. "K-connection Maintenance algorithm for Balanced Routing in Mobile Ad Hoc Networks." *International Journal of Computer Networks and Communications (IJCNC)* 1, no. 3 (2009): 105-111.
- [13] Wadbude, Durgesh, and Vineet Richariya. "An efficient secure AODV routing protocol in MANET." *International Journal of Engineering and Innovative Technology (IJEIT) Volume 1* (2012): 274-279.
- [14] Neelaveni, R. (2019). Performance Enhancement and Security Assistance for Vanet Using Cloud Computing. *Journal of trends in Computer Science and Smart technology (TCSST)*, 1(01), 39-50.
- [15] Sathesh, A. (2019). Optimized Multi-Objective Routing For Wireless Communication With Load Balancing. *Journal of trends in Computer Science and Smart technology (TCSST)*, 1(02), 106-120.
- [16] Karp, Brad, and Hsiang-Tsung Kung. "GPSR: Greedy perimeter stateless routing for wireless networks." In Proceedings of the 6th annual international conference on Mobile computing and networking, pp. 243-254. 2000.

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