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RESEARCH ARTICLE

Enhanced Route Discovery Mechanism of Ad-Hoc On Demand Distance Vector for MANET

May Sayed A. Nouh
Electronics & Communications Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.
may.nouh@yahoo.com

Salwa H. El-ramly
Electronics & Communications Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.
salwahelramly@gmail.com

M. Zaki
Computers and Systems Department, Faculty of Engineering, Al Azhar University, Cairo, Egypt.
mzaki.azhar@gmail.com

Husein A.A Elsayed
Electronics & Communications Department, Faculty of Engineering, Ain Shams University Cairo, Egypt.
helsayed@eng.asu.edu.eg

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Abstract – The Ad-hoc On Demand Distance Vector (AODV) is one of the most famed reactive routing protocols, which is used in Mobile Ad Hoc Networks (MANETs) for routing purposes, where the routes are built only when it is required. The AODV is related to the problem of route constructing and maintaining among any two-node in the presence of the dynamic topology of a network. High routing control packets, during route construction, is a limiting factor of AODV. Also, the route created during route discovery process may not be optimum (in terms of the number of hop counts between the originating and target node). The construction of non-optimal route arises from many reasons such as temporary congestion of one or more links in the short path to the target node, or nodes in those paths may contend the channel late, or the nodes may be busy for that moment to entertain other engagement. Moreover, during the route discovery phase, a large amount of unnecessary control packets may be generated which result in the debasement of the performance and the efficiency of the protocol by congesting the network and increasing the overhead. In this article the cases at which non-ideal routes are created and unimportant control packets generated during route discovery process will be identified. The modified AODV ($AODV_{\_MOD}$) with enhanced route discovery mechanism is proposed that will be used to avoid these cases by suppressing unimportant control packets and avoiding non-ideal routes formation. Simulation results, conducted in network simulator (NS2), prove the skillfulness of the proposed enhanced route discovery scheme from point of view of packet delivery ratio, end-to-end delay, and normalized overhead.

Index Terms – Overhear, AODV, DSR, DSDV, RREQ, RREP, Broadcast, Collision and Overhear.

1. INTRODUCTION

"Mobile Ad hoc Network" is a wireless network, in which the nodes are allowed to move freely in any direction. Due to the node mobility, a node can insert or depart the network at any time. If the two communicating nodes are within the same area of their transmission range, the routing is not needed. Otherwise, other intermediate nodes are required to realize the function of routers to set up a route in a hop-by-hop manner between the two nodes [1, 2]. The aim of a routing algorithm is to specify a procedure to transfer a data packet from the originating to target node. To make correct routing decision, the routing algorithm must select some criteria for making routing decision, (e.g., bandwidth, number of hop counts, transmission power, etc.)

Due to the nodes mobility, the exchanged routing information between nodes should be modified to reflect changes in network topology, so the conventional routing algorithms of the wired/wireless networks cannot be used directly in MANET. There are different algorithms to follow up the variability of topology of network and to rediscover new routes when the old routes fail. MANET has two fundamental sorts of "routing protocols": “Proactive routing protocols”, and “Reactive routing protocols” [3-6]. “Proactive routing protocols” (e.g. , “DSDV” and “OLSR”), also called “table driven” routing protocols, in which the routing information have been exchanged among the nodes at regular intervals and the routes are calculated perpetually among nodes, whatever the paths are in use or not. This results in many wasted resources of the network (e.g., energy and bandwidth). On

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contrast, in "reactive routing protocols" (e.g., "AODV" and "DSR"), also called "on demand routing protocols", instead of exchanging routing information among nodes at regular intervals, the route establishing solely in case of being needed.

"Reactive routing protocols" shun the cost of routes maintenance which are not being used and also never send excessive control packets. Therefore, "reactive routing protocols" do well than "proactive routing protocols".

"Ad hoc On Demand Distance Vector (AODV)" is an efficient reactive scheme for routing purpose [7]. It depends on the hops style. For route discovery, "AODV" uses only two guidance packets, "Route Request packet (RREQ)" and "Route Reply packet (RREP)". To establish route between any two nodes, "RREQ" is sent from the originating node. When "RREQ" reaches the target node, it answers by transmitting "RREP" to originator to confirm the establishment of the route.

AODV protocol has some advantages such as the route creation is "on demand" and the usage of "destination sequence number", as time stamp, for getting most recent route to the target node. Moreover, for route maintenance, the hello packets are used and they do not cause significant unimportant control packets in the network because they are range limited. The disadvantage of AODV protocol is the heavy control packets due to the flooding of RREQ packet and multiple unnecessary RREP packets for responding to a single RREQ packet during the route discovery phase [8]. Also, the selected route may not be optimum (in terms of hops number between the originator and target).

This article aims to signify the cases at which non-ideal routes are created and unimportant RREP is generated during route discovery process in AODV and to propose and test a solution that will be used to avoid or to eliminate these cases by suppressing unimportant RREPs and avoid non-ideal routes that are to occur.

The remaining structure of the article is as follow: In Section 2, the related work of various routing methods has been discussed. The AODV protocol is briefly reviewed in Section 3. Then Section 4 reports the cases at which non-ideal routes are created and unimportant RREP is generated during route discovery process in AODV. The proposed technique for suppressing unimportant route reply (RREP) packets and avoiding non-ideal route creation is presented in Section 5. In Section 6, the simulation environment and performance metrics are given. The simulation results and analysis are then presented in Section 7. Finally, we conclude the paper in Section 8.

2. RELATED WORK

P. Wannawilai and C. Sathitwiriyawong [9] introduced new scheme, called (AODV-SBA). Where, routes are being discovered by the method that shuns congestion and minimizing extravagant routing overheads. The idea of suggested scheme is based on measuring congestion of local network by using information from the MAC sub-layer. Hence, precluding the congested routes from being discovered. So, the proposed technique improves the performance of a high congested network

A. Abu-Ein and J. Nader [10] proposed a modified version of the original AODV, called (PH-AODV) routing protocol. Where, route selection is based on two factors: the power level of node and the hops number. So that, selected route should consist of relatively minimum hops number and the nodes forming the route must have high power level. Hence, performance of suggested scheme does well off the original "AODV" from point of view of "end-to-end delay", "packets dropping" and "throughput".

Julith Jacob and Shinu Koyakutty [11] presented a novel algorithm, named "Nominated Neighbors to Rebroadcast the RREQ (NNRR)", to minimize the surplus of "RREQ packets" during "route discovery". The proposed algorithm depends on the information of the location of the nodes inside the network. To limit the route discovery area, the proposed algorithm chooses four neighboring nodes as elected nodes to rebroadcast the "RREQ packet" in case of these nodes have not available path to the target node and applies the idea of "expected and requested zone" of "LAR protocol". The developed algorithm results in reduction of the "routing control packets".

Priyaganga G. and Madhumita C. [12], introduced a novel algorithm to reduce routing overhead in MANET. The proposed technique permits the intermediate node to rebroadcast the RREQ based on a newly computed factor, called efficient rebroadcast delay, D_R. This factor is a function of three network parameters, link quality (in terms of S/N ratio) between the nodes, energy level and routing load at each node. Hence, the node efficiency is determined according to the value of its rebroadcast delay, which is located between 0 and 1. If $0<D_R<1$, then the intermediate re-broadcast (RREQ). Otherwise discard (RREQ). The proposed algorithm results in the discovery of reliable and stable route with minimum routing load.

3. AD-HOC ON-DEMAND DISTANCE VECTOR (AODV)

"AODV" is "reactive routing protocol" [7, 13, and 14]. Therefore, routes are established only when it is required (i.e., on demand). "AODV" composed of 2- stage: "route discovery" and "route maintenance".

In case of an originating node has the desire to set up communication with a target node and there no route between them, it initiates "route discovery procedure". The originating node transmits "RREQ" to its neighbors. When "RREQ" reaches any intermediate node, it renews its information for the originating node and makes up backward path toward

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originator in its route cache. Among RREQ fields, "originator address", "broadcast ID" and "destination sequence number" which an originating node knows it [15-17]. When the first "RREQ" reaches any intermediate node does not possess valid route to the target node. It rebroadcast the "RREQ". Based on the "originator address" and "broadcast ID", nodes can avoid duplication of receiving the same "RREQ". If nodes received the same “RREQ” two times, the later comer will be discarded and do not resend it. On the other hand, when the "RREQ" reaches the target node or any intermediate node has valid route to the target node, it transmits "RREP packet", by using the hops style, to the originating node. During journey of "RREP" to the originating node, each intermediate node creates "forward path" to the target node. When the "RREP" reaches the originating node, it stores the route to the target node in the route cache and can begin sending the "data packets" to the target node. If multiple "RREP packets" received by the originating node, the route which have smallest hops number will be selected.

During "data packets" transmission, if link has been failed, the predecessor node from the failed link transmits "Route Error packet (RERR)" to the originating node by hops style. During journey of the "RERR packet" to the originating node, each intermediate node upstream of the failed link disproves routes to any unreachable target node. On receiving "RERR packet", the originating node rejects the failed route from route cache and restarts again "route discovery process".

4. NON-IDEAL ROUTE FORMATION AND UNNECESSARY RREPS GENERATION

This section presents the analysis of the problem of non-optimal route discovery in AODV and generation of unimportant RREPs by taking “Route Request” cycle and “Route Reply” cycle separately.

4.1. Route Request Cycle

In the route discovery process, each node keeps track of "RREQ packets" it has been received, this will help to discard duplicates received from different neighbor nodes. To detect duplication, the nodes use "originator address" and "broadcast ID" of the “RREQ packet”. If nodes receive “RREQ” more than one, it will drop late comer whatever hop-count it has. However, “RREQ” with the smaller number of hop- count may arrive late due to temporary link congestion, channel access and collision at that time. As a result, “RREQ” which passes through less number of hops may be dropped because of its late arrival. Thus, a longer (non-ideal) path may be taken as a path for routing the data to the target node. This situation is illustrated, as an example, as shown in Figure 1. When node "S" has the desire to make up communication with node "D". It investigates its "route cache", if it does not found valid route to node "D", then node "S" starts the "route discovery process", by transmitting "RREQ packet" to neighboring nodes (A, E, K). On receiving the "RREQ" at time t_1, assume that the nodes E and K are busy or the links K-F, K-J, and E-H are temporarily congested or collision occurs in these links. This will results in arriving three "RREQ packets" to the target node "D" at different times. The first one at time t_5 through the path <S-A-B-C-N-D>, the second one at time t_7 through the path <S-K-J-D> and the third one at time t_9 through the path <S-E-H-G-D>. On receiving the first “RREQ” at time t_5, target node "D" immediately transmits "Route Reply (RREP) packet", with hops number =5, to the originating node "S" through the path < D-N-C-B-A-S>, which is not the optimal path/route. And the other two “RREQs”, which are lately arrived, will be neglected by node "D". Therefore, the optimal route, with hops number = 3, through <S-K-J-D> does not taken as route between node "S" and "D", but the non-optimal route, < S-A-B-C-N-D>, is selected as route between node "S" and "D".

We have proposed an algorithm that considers all RREQs irrespective of their arrival time at a node and decides based on both the hop-count and “destination sequence number” before dropping a lately arrived RREQ. By considering hop-count, we may avoid the formation of a longer path as a route. The detail of the algorithm is discussed successively.

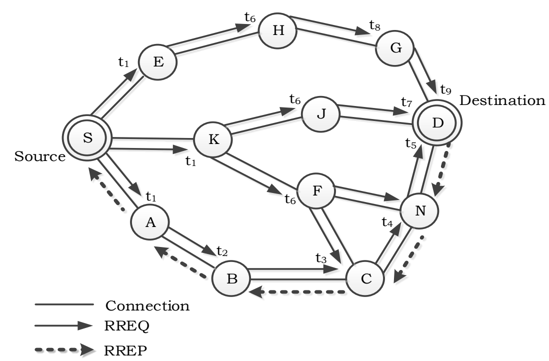

Figure1 Non-Optimal Route Formation

4.2. Route Reply Cycle

The second phenomenon that we have observed is the propagation of ineffective RREPs through the network. This happens in some situations at which RREPs generated by intermediate nodes and/or target nodes pass through more hops than other RREPs to reach to the originating node of the respective RREQ, which are dropped by the originator on their arrival based on the comparison of their hop-count. This can be illustrated, as an example, as shown in Figure 2. Whenever node "S" initiates the "route discovery process" by flooding "RREQ packet", it will propagate through network till it arrives to the intermediate node "J" and "G" as well as the target node "D". Assume that each one of intermediate nodes J and G has valid route to the target node "D". On receiving "RREQ packet" at time t_6, node "J" sends "RREP packet" to the originating node "S" through path <J-K-S>, with hop count = 3, at time t_5

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node "D" sends "RRPE packet" through path <D-N-C-B-A-S>, with hop count = 5 and at time t_7 node "G" sends "RRPE packet" through path <G-H-E-S>, with hop count = 4. On receiving these three "RREPs", the originating node "S" elects the "RREP" of the minimum hops count, (i.e. "RREP" of node "J", with hops count = 3, through path <J-K-S>). The other two "RREPs" of "G" and "D" will be dropped on their arrival at the originating node "S" where, they contain larger hops count. However, these two "RREPs" were flooded the network to reach to the target node "S", so this may increase the "routing overhead" and congest the network unnecessarily which will not result in route to the required target. They might even cause long route to occur which is taken as route between the two nodes if the "RREP" following the short path is dropped due to collision or other. Problem of the unnecessary "RREPs" will have significant drawback in case of high- density "Ad-hoc network". Solution for the stated problem is also added in the proposed algorithm which is discussed in the following section.

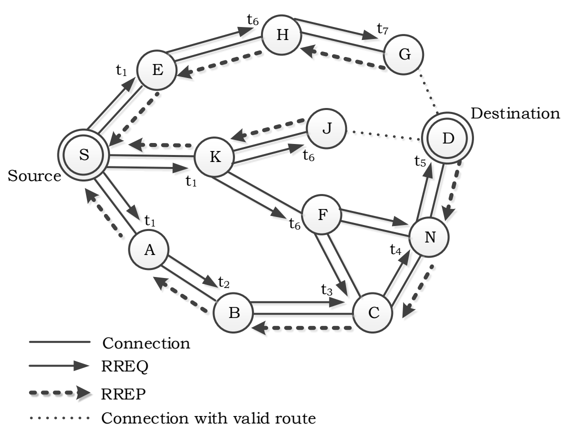

Figure 2 Generation of Unnecessary RREP

5. AODV WITH ENHANCED ROUTE DISCOVERY MECHANISM

Based on the above-mentioned problems, we have proposed a solution that may helpful to enhance the route discovery mechanism. The proposed solution is based on two main ideas. The first one is based on the concept of Overhear RREP packet [18-20], which is the feature of DSR routing protocol used by a node to learn more routes from RREP packets that are not directed to it by promiscuous listing. The second idea is that all the RREQs should be processed and evaluated by a node irrespective of their arrival time. The proposed solution is discussed in the following two cases:

5.1. Non - Optimal Route Suppression

For the case at which non-optimal route is to occur, we have proposed an algorithm that may suppress the non-optimal route which is to be built, so that optimal route can be formed. This can be achieved by processing and evaluating all the received RREQs, irrespective of their arrival time, at all nodes instead of dropping the late coming RREQ received after the first RREQ. Based on the hop-count, Nodes are allowed to perform a comparison between the current received RREQ with the previously received one in addition to the comparison of "destination sequence number". The result of the comparison is used in deciding for further broadcasting, replying or dropping the "RREQ" according to the following rules, as illustrated in Figure 3.

5.1.1. In Case of Intermediate Node

Whenever "RREQ" has been received by intermediate node for first time, it should obey the following rules:

1- If the received RREQ has Overhear RREP, (with hop-count H_S), in the Snoop Cache and RREP, (with hop- count H_{RP}), in the Route Cache. If $H_S <= H_{RP}$, then the RREQ is dropped.

2- If the received RREQ has only Overhear RREP, then the RREQ is dropped.

3- If there is no Overhear RREP or $H_{RP} < H_S$, then the node sends RREP with hop count H_{RP}.

4- If there is neither Overhear RREP nor RREP, then the node attaches its address in "route record" of RREQ, and rebroadcast RREQ.

When the current received RREQ is not the first one has less hop-count (H_{RQ}) than the previously received RREQ (H'_{RQ}), then the node repeats the above steps form1 to 4. Otherwise, the late comer will be dropped by the node.

5.1.2. In Case of Target Node

When "RREQ" has been received by the target node for first time, it should obey the following rules:

1- If there is neither Overhear RREP nor "RREP", then the target node transmits "RREP" through reverse path of the received RREQ.

2- If there is only RREP, (with hop-count H_{RP}), in the Route Cache. If $H_{RQ} < H_{RP}$, then destination node sends RREP through the reverse path of the received RREQ. Otherwise, the node sends RREP with hop counts H_{RP}.

3- If there is only Overhear RREP, (with hop-count H_S), in the Snoop Cache. If $H_{RQ} < H_S$, then destination node sends RREP through the reverse path of the received RREQ. Otherwise, the node drops RREQ.

If the received RREQ has Overhear RREP, (with hop-count H_S), in the Snoop Cache and RREP, (with hop-count H_{RP}), in the Route Cache. If $H_S > H_{RQ} < H_{RP}$, then the target node sends RREP through the reverse path of the received RREQ. Else if $H_{RQ} >= H_S <= H_{RP}$, then the RREQ is dropped. Otherwise, the destination node sends RREP with hop-count H_{RP}.

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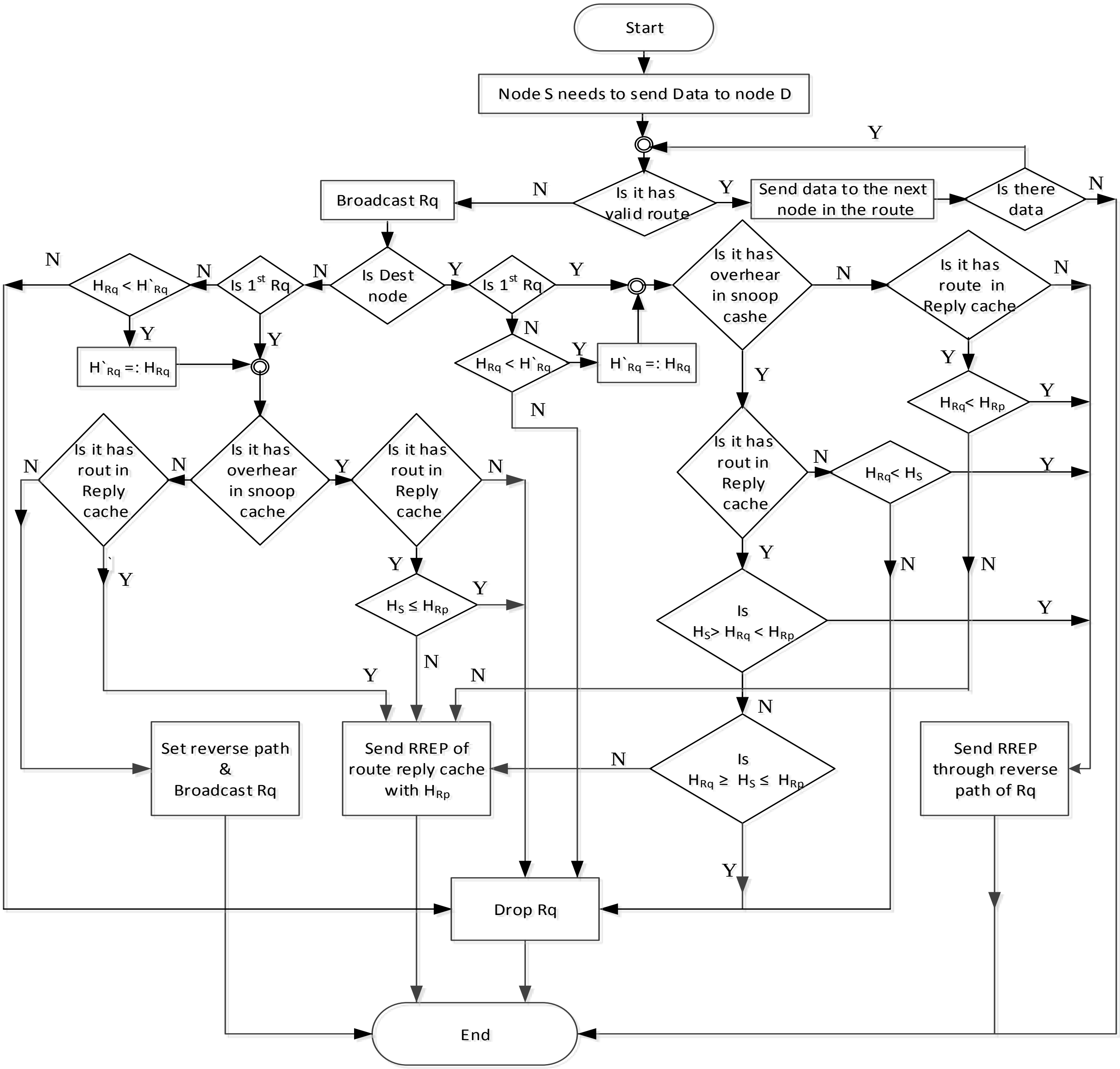

Rq: Route request
Rp: Route reply
H_{Rq}: Hop count in the current Rq
$H`_{Rq}$: Hop count in the previous Rq
H_{Rp}: Hop count in Rp
Hs: Hop count in snoop cache (overhear)

Figure 3. Flow Chart that Shows Action of Node on Receiving Route Request Packet

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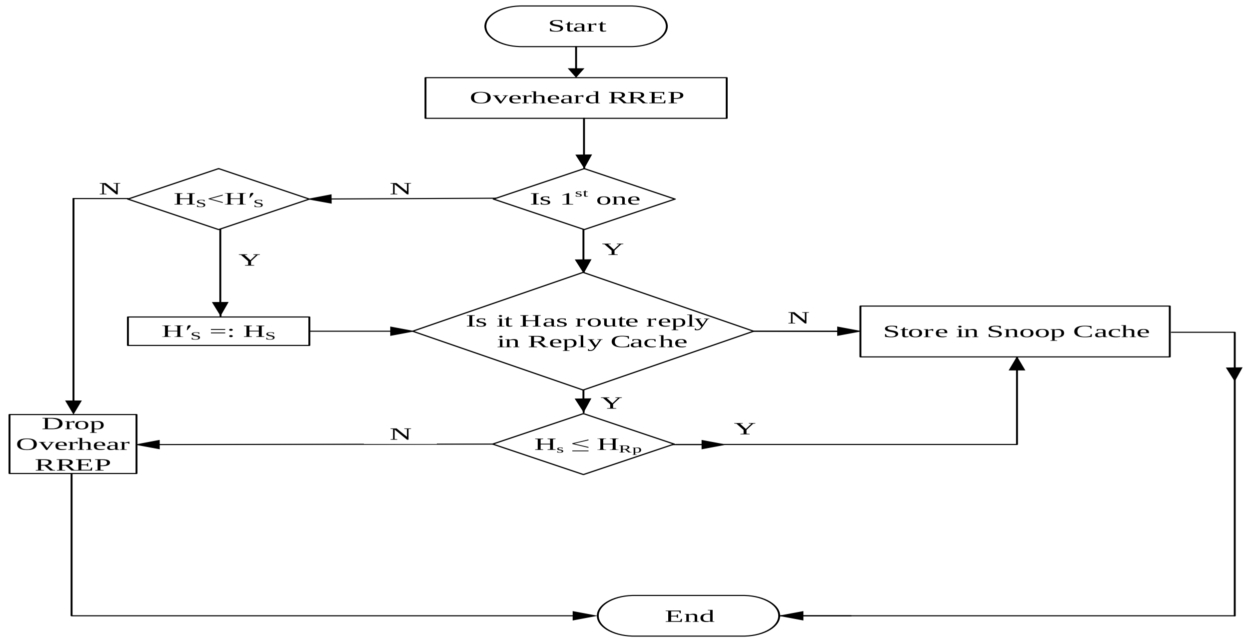
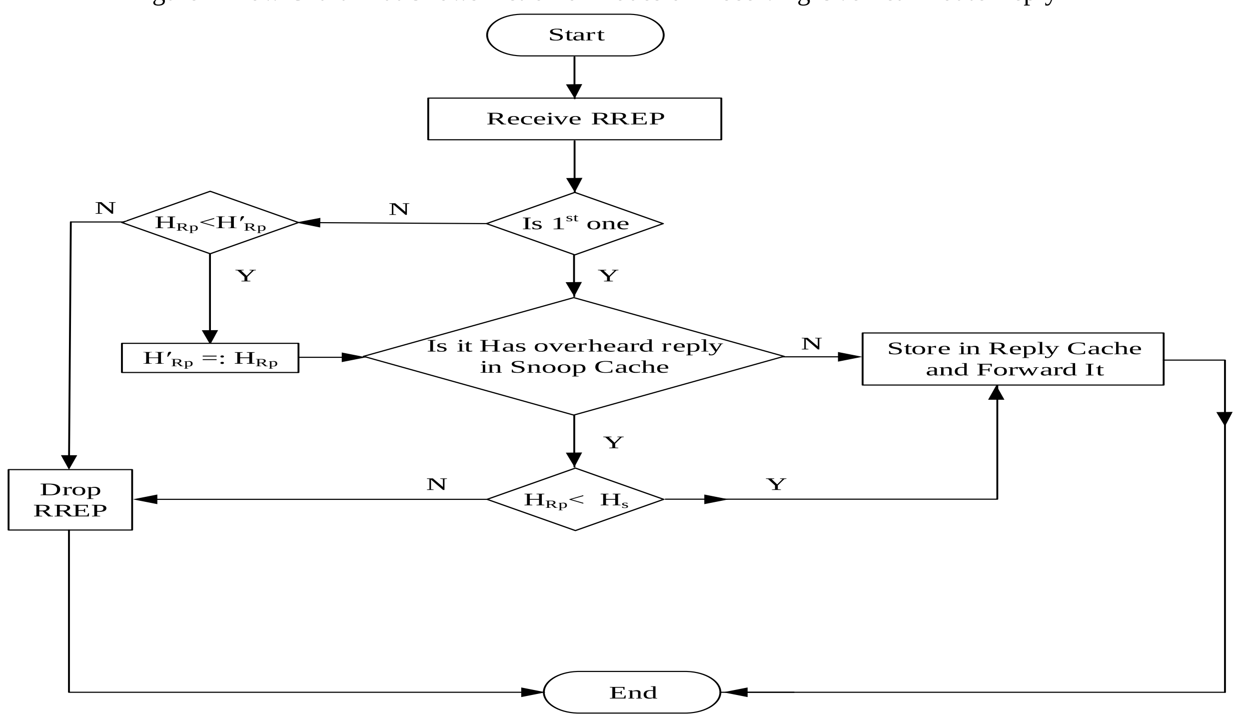


H_{Rp} : Hop count of rout reply in reply cache
H_S : Hop count in the current overhear reply
H'_S : Hop count in the previous overhear reply

Figure 4 Flow Chart That Shows Action of Nodes on Receiving Overhear Route Reply



H_{Rp} : Hop count in current RREP
H'_{Rp} : Hop count in previous RREP
H_S : Hop count in snoop cache (overheard)

Figure 5 Flow Chart That Shows Action of Nodes on Receiving Route Reply

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5.2. Unnecessary Route Reply Suppression

The unnecessary Route Reply Suppression is handled by adding a feature to AODV nodes so as to Overhear RREP packet that is not directed to it. In the proposed algorithm, the Overheard RREP is examined for further processing. To facilitate the searching and comparison in the Route Cache and Snoop Cache, we have included additional information in the "RREP packet" such as "broadcast ID" of the respective "RREQ", total hops number among the originator and target node, and originator address that will help to determine further processing. On hearing RREP by a node (i.e. RREP not directed to a node), it obeys the following rules, as shown in Figure 4.

1- If Overheard RREP, with hop-count H_S, is the first one and there is no RREP in the Reply Cache for the same required route, then the Overheard RREP is stored in Snoop Cache. In the case of there is RREP in the Reply Cache with hop count H_{RP} and $H_S < H_{RP}$, then also the Overheard RREP is stored in Snoop Cache. Otherwise, if $H_S > H_{RP}$, then the Overheard RREP is dropped.

2- If the current Overheard RREP is not the first one has less hop-count H_S than the previously received one with H'_S, then the node repeats step1. Otherwise, the node drops the late comer.

In the case of receiving RREP by a node (i.e. RREP directed to a node), it obeys the same above two steps, as shown in Figure 5.

6. SIMULATION ENVIRONMENT

6.1. Simulation Model

Table 1: Simulation Parameters

Simulation Parameters	Values
Simulator	NS2 (V 2.35)
Topology Size	800m x400m
Number of Nodes	50 – 90
Transmission Range	250m
Channel Type	Wireless
MAC Layer	802.11
Radio propagation Model	Two Ray Ground
Interface Queue Length	50
Traffic Type	CBR
Number of Sources	25, 45
Pause Time	0 – 500 sec.
Mobility Speed	5m/s – 55m/s
Mobility Model	Random Waypoint
Packets Rate	4 packets/s
Simulation Time	500 sec.

To test and evaluate the performance of the proposed scheme, we used simulation system, named NS2. AWK command has been used to analyze the experimental results contained in the generated output trace files. The traffic sources that we have used are Continuous Bit Rate (CBR). Node mobility description is based on the "random waypoint model". The pause time is varied from 0 to 500 second. A pause time 0 sec. means the nodes are continuously in motion and pause time 500 sec. means nodes are stationary. Table 1 illustrates the simulation parameters.

6.2. Performance Metrics

The performance comparison of suggested algorithm ($AODV\_{MOD}$) against the standard "AODV" have been carried out under the same conditions, such as identical mobility and traffic scenarios. To evaluate the two algorithms in all important aspects, the following three performance metrics have been used.

1. *"Packet Delivery Fraction" (PDF)*: It is the ratio of number of received data packets at the target node to the number of data packets transmitted from the originating node. Where, high PDF meets good performance.

2. *"Average End-to-End Delay"*: it is the consumed average time during journey of data packets from the originating node to the target node. It involves "processing time", "waiting time" and "propagation delay". Where, minimum "end-to-end delay" meets better performance.

"Normalized Routing Overhead": It is the ratio of sum of all transmitted routing packets to the sum of all data packets delivered to the target. Where, minimum "Normalized Routing Overhead" ratio meets better performance.

7. SIMULATION RESULTS AND ANALYSIS

The following scenarios have been taken into consideration to compare the simulation results of the proposed $AODV\_{MOD}$ and the original AODV, based on the aforementioned performance metrics.

7.1. Scenario 1:

In this scenario, the pause time of nodes is changed from 0 to 500 sec. The number of nodes and source connections is fixed at 50 and 25 respectively, node speed is fixed at 5 m/s and the other network parameters are considered as in Table1.

7.1.1. Packet Delivery Fraction

Figure 6.a shows PDF versus pause time for the studied protocols. It is clearly seen from the graph that as the pause time increases, the PDF of both protocols increases because the network becomes stable since the routes are stable and valid for a long time. On the other hand, lower pause time (i.e., nodes have higher mobility) results in lower PDF due to the increase of packet drops, since the routes are unstable. The $AODV\_{MOD}$ has a higher delivery ratio, where the average PDF=88.63%, than the original AODV, where the average PDF=69.09%, this

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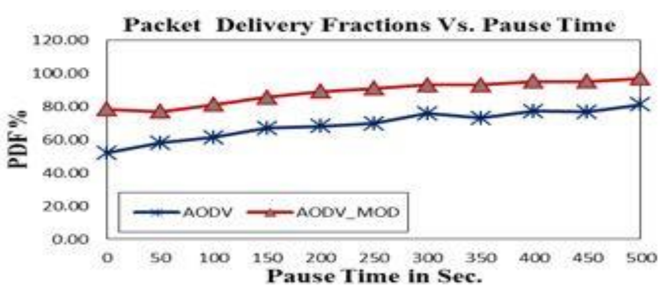
is due to the enhanced route discovery mechanism. In general, the large route length leads to the high probability of packets drop. The AODV_$_{MOD}$ can create shorter route length, which result in the improvement of PDF. For the same reason, the improvement of PDF of AODV_$_{MOD}$ is more observable in a high dynamic network.

7.1.2. Average End-to-End Delay

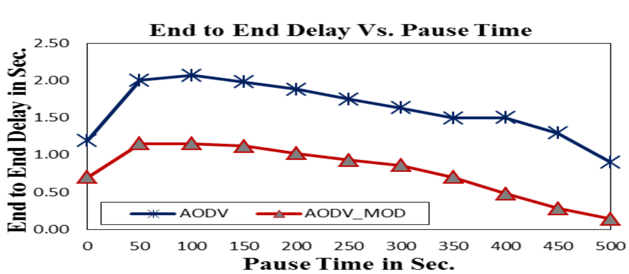
Figure 6.b illustrates the "end-to-end delay" of the two routing protocols. We note that, the delay time for both protocols decreases with increasing the pause time because as the mobility decreases the network becomes stable and the routes are available for long periods. The AODV_$_{MOD}$ has lower "end-to-end delay", where the average delay=0.77sec, than the original AODV, where the average delay= 1.61sec. This is because the enhanced route discovery mechanism can create shorter route than that taken by the original AODV, which results in reduction of the "end-to-end delay".

7.1.3. Normalized Routing Overhead

Normalized routing overhead versus pause time for the studied protocols is shown in Figure 6.c. We note that, as the mobility of nodes increases (i.e., at low pause time), the possibility of link failure increases and hence, the routing overhead increases, due to the rediscovery of the route, in the two protocols. The routing overhead of AODV_$_{MOD,}$ (Avg. NRL=1.18), is lower than the original AODV, (Avg. NRL=1.18), because the enhanced route discovery mechanism can avoid unnecessary route reply packets from flooding the network.



(a)



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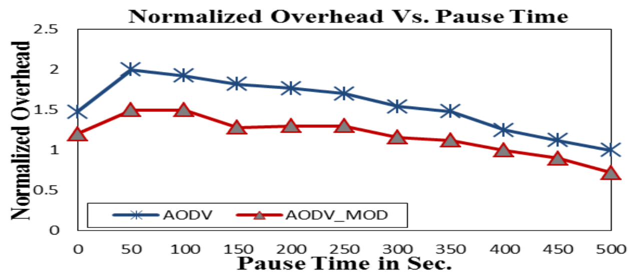

(c)

Figure 6. Varying Network Pause Time

7.2. Scenario 2

Effect of node speed on performance of the AODV and AODV_$_{MOD}$ is addressed in this scenario. The nodes speed is varied between 5m/sec and 55m/sec. The nodes number and source connections are fixed at 50 and 25 respectively, pause time is fixed at 5 sec. and the other network parameters are listed in Table1.

7.2.1. Packet Delivery Fraction (PDF)

Figure 7.a shows the packet delivery fraction against nodes speed of the AODV and AODV_$_{MOD}$. PDF for both two protocols decreases as the mobility speed increases, because at high speeds, possibility of link failure may occur more recurrently and therefore the PDF is decreased. The AODV_$_{MOD}$ has a higher delivery ratio under the same node speed due to the enhanced route discovery mechanism, where the ideal (shorter) route is selected.

7.2.2. Average End-to-End Delay

Figure 7.b illustrates the "average end-to-end delay" versus nodes speed of the AODV and AODV_MOD. We observe that, the average delay of both two protocols increases as the mobility speed increases. This due to, the frequent changing of network topology results in high probability of links failure which in turns may lead to extra "route discovery process", so the average delay have been increased. Also, we note that, in case of dynamic topology, the AODV_MOD has better performance than "AODV" because the proposed scheme can create shorter path than that taken by the original AODV, which leads to reduction of the "end-to-end delay".

7.2.3. Normalized Routing Overhead

Figure 7.c shows the "normalized routing overhead" versus nodes speed of the two routing protocols. It is noted that, as the mobility speed increases, the "routing overhead" have been increased. This due to, the frequent changing of network topology results in high possibility of links failure which in turns may lead to extra "route discovery process" and hence the routing overhead will be increased. The routing overhead of

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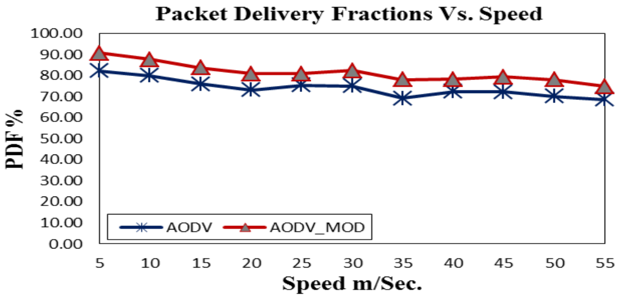
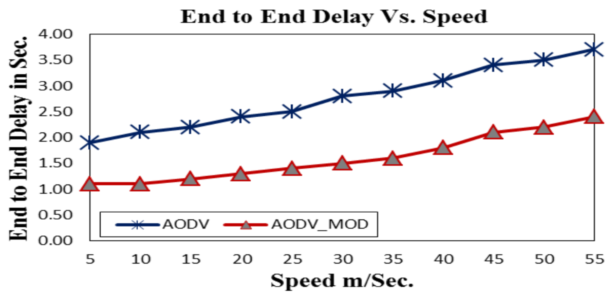
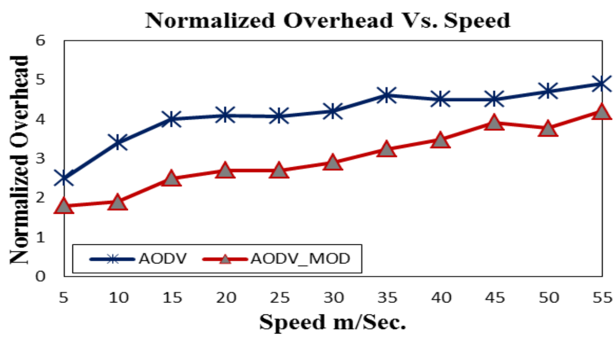
AODV_MOD, (Avg. NRL= 3.01), is lower than the original AODV, (Avg. NRL= 4.14), because it suppresses unnecessary route reply packets from flooding the network.



(a)



(b)



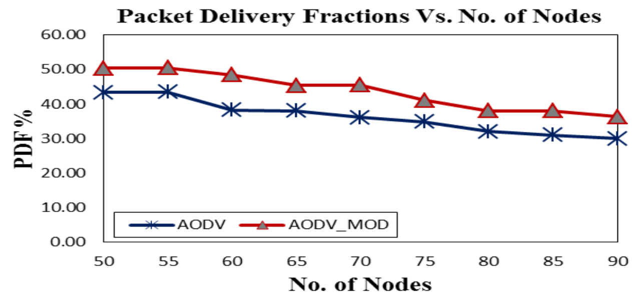
(c)

Figure 7 Varying Network Mobility Speed

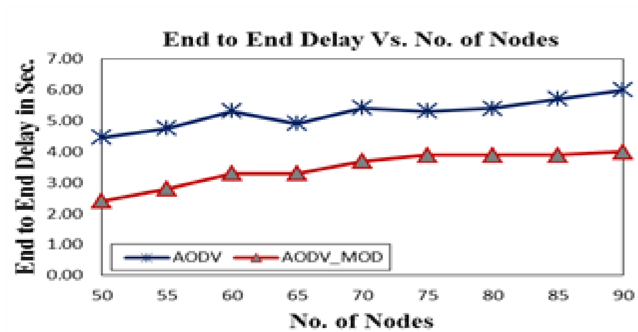
7.3. Scenario 3

The effect of nodes density on performance of the two routing protocols is addressed in this scenario. We have varied the number of nodes from 50 to 90 with step 5, keeping the pause time to be 5 sec, node speed is 10m/s and number of source connections is 45. Other parameters remain fixed as shown in Table 1.

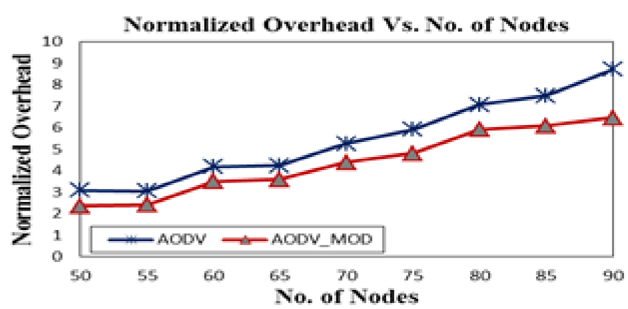
As shown in Figure 8, as the nodes density increases, the coinciding packets from various originating nodes may have higher likelihood in channel contention at the same intermediate nodes, which results in lower packet delivery ratio, higher delay and higher normalized overhead. The AODV_MOD has better performance than AODV because the enhanced route discovery mechanism can avoid the unnecessary control packets and create shorter route than that taken by the original AODV under the same number of nodes, which is useful to improve the "packet delivery ratio, diminish the "end-to-end delay" and control packets.



(a)



(b)



(c)

8. CONCLUSION

In this article an AODV_MOD, through the enhanced route discovery mechanism, is proposed. It is the modified version of the original "AODV". The proposed protocol has two main contributions: the first one is avoidance non-ideal routes

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formation and the second one, suppression of unimportant control packets. And it is compared with the original "AODV", for different scenarios, in terms of "packets delivery fraction", "end-to-end delay" and "normalized routing overhead". It is observed that, the AODV_MOD has better performance than the original "AODV".

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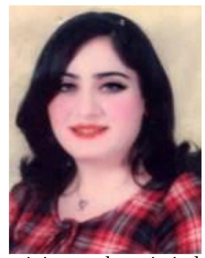

May Sayed A. Nouh is a lecturer at the electronics and communications Dept., the higher technological institute tenth of Ramadan city, Cairo, Egypt. She received her B.Sc. from higher technological institute tenth of Ramadan city in 2010. Since then, she served in different positions and built both practical and theoretical experience in electronics and communications field. Her areas of interest include mobile systems, networks and wireless communications. She supervised on different training students in industrial areas.

Salwa H. EL-Ramly received the B.Sc. and M.Sc. degrees from Ain Shams University, Cairo, Egypt in 1967 and 1969 respectively. She received her D.E.A. (Diplome d'Etudes Approfondies en Electronique) from Grenoble University, France. In 1976, she received her PhD in Electrical Engineering (Communications) from Nancy University, France. From 1976 to August 1982 she was an assistant professor in the Electronics and Communication Engineering Dept., Faculty of Engineering, Ain Shams University. After which she served for 5 years, as an Associate Professor, in the same Faculty. Since 1989 she is a professor of communications systems in the same department where she is also the director of the "Signal Processing & Communications Research Lab" (CSPRL).

M. Zaki is the professor of software engineering, Computer and System Engineering Department, Faculty of Engineering, Al-Azhar University at Cairo. He received his B.Sc. and M.Sc. degrees in electrical engineering from Cairo University in 1968 and 1973 respectively. He received his Ph. D. degrees in computer engineering from Warsaw Technical University, Poland in 1977. His fields of interest include artificial intelligence, soft computing, and distributed systems.

Hussein A. A. Elsayed is an Assistant Professor at the Electronics & Communications Engineering Dept., Faculty of Engineering, Ain Shams University, Cairo, Egypt since 2009. He obtained his BSc and MSc from Ain Shams University in 1991 and 1995 respectively; and the PhD from Electrical Engineering Dept., City University of New York, New York, NY, USA in 2003. Since then, he served in different positions and built both practical and theoretical experience in the area of Communication Networks. He is an IEEE member since 1991. His areas of interest include Telecommunication Networks, Mobile Systems, Sensor Networks, and Network Security, where he has a long list of Journals and conferences publications. He supervised several PhD, MSc thesis, and graduation projects in those areas. Throughout these years of experience, he obtained different grants and awards from both academic and industrial sources.