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Analysis, Simulation and Compare Two Routing Algorithms SMORT and DAR in Ad-Hoc Networks

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ABSTRACT

Ad hoc networks are a new paradigm of wireless communications. There is no fixed infrastructure such as base sites or switching centers; meanwhile, the nodes are so far from each other that their messages could be reached their destinations. In this paper, we explained and compared a multi- path routing SMORT protocol and DAR protocol for routing in Ad hoc networks along with description of their applications.

KEY WORDS: Ad hoc network, SMORT algorithm, DAR algorithm, routing.

1-INTRODUCTION

Ad Hoc Networks are new samples of wireless telecommunication for mobile devices. They are living for 70 years and are constructed for military reason. War fighter networks and their mobile platforms on battlefield are classic examples of Ad hoc network. Later found that they also can be helpful in commercial and industrial areas. These networks are consisted of a set of distributed nodes which make a temporary network, without supporting center management. The most natural advantage of these networks is the lack of needing of physical structures, and the ability to change their virtual structures. These special features need specific security methods and routing protocols. In Ad hoc networks, the nodes of networks don't know the prior knowledge of the network topology involved. Therefore, they have to discover the destination for communicating with other nodes in the network. Here, the main idea is that a new node attends (presents himself) arbitrarily throughout the network; and listens to its neighbors. Thus, the node acquires certain information from adjacent nodes, and learns how to achieve them. So, it either knows all other nodes or how to achieve them. Routing protocols between both nodes of network are difficult, because every node could move randomly and even could be removed from the network, periodically. It means that once a path is optimal, it may not exist originally a few seconds later. Three categories of routing Protocol related to these networks are introduced:

1- Table Driven Protocols
2- On-Demand Protocols
3- Hybrid Protocols

In the first method, by saving the local information of other nodes in the network, every node use the routing information; and this information is used for transferring data through various nodes. Second, on-demand routing protocol is consistent with dynamic environment of ad hoc network, due to overhead of the little routing and quick reply to path breaking[1,5,6,8-10]. Nodes hold only routes with related destinations. When a route is needed to a destination, the nodes send a route request. An on-demand routing protocol usually consists of two phases: route discovery and route maintenance. In the route discovery phase, the source node sends out a route request packet (RREQ) to find a route to the destination node. When a packet arrives at an intermediate node (not its destination), the node checks to see if it has a route to the destination and sends out a route reply packet (RREP) to the source if such a route is found. After the source receives the RREP, it begins to send out data packets using the newly created route. When a packet arrives at a node, and the link is broken due to a node on the route moving away or due to node failure, route maintenance phase is initiated. In this phase, the node sends out an error packet to the source. Upon receiving the error packet, if the source still needs a route to the destination and does not have an alternative route to the destination, the source re-initiates a RREQ to find a new route. although on-demand routing protocols have satisfactory performance in small networks, its efficiency reduces by increasing the number of nodes in a big network. Third method is a combination of both discussed protocols. They use vector-distance routing protocol methods for finding the shortest distance; and report the routing information only if there are changes in the network topology; and information routing recorded in this zone such as zone routing protocol (ZRP)[3,7,12-14].This paper is organized in four other sections; in section 2, the algorithm "SMORT" will be described in details; in Section 3, "DAR" will be explained; and in Section 4, we will simulation and Analyze both algorithms; In the end, According to results obtained in pervious section, we will compare SMORT and DAR. So we will describe each functional areas.

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2-Multiple-Path and Incremental on-Demand Routing (SMORT)

SMORT[1] is developed multiple-path with routing protocol "AODV[2]". Routing protocol" AODV" is an on-demand routing protocol where all paths discovered if it is necessary, and stored only if they are used. Paths are discovered during a Flooding where the network nodes are directed to the destination in the process of searching a route. When a node with a destination route is discovered, that route is reported back to the target node which requested the route. The main objective of "SMORT" is reducing the amount of routing overhead generated by a routing protocol. On-demand single-path routing uses multiple-path routing. SMORT has three essential steps:

- Route discovery
- Route responding
- Route keeping

When a node of a route needs multiple destinations, it starts to process the first discovered route. By sending a packet, requesting route started in the network. Middle nodes receives requesting route; if there is a certain destination route, a route responding packet is sent to the source. Otherwise, they request again. Finally, when requesting destination is received, process of route responding is started by sending a route responding packet to the source. Unlike AODV,SMORT allows the nodes to receive several copies of a requesting route packet to calculate the abilities of harmless and multiple-path routes. In addition, the responding destination to the multiple-path copies of requesting route in the same ways. During the route discovery phase, requesting route to the source node is recorded through reverse path in a special table. This happens in order to avoid loops in routes that may accept multiple-path copies of the route requesting packets and route responding ones which carry the full path to the destination. Although in the route discovery phase, it is prevented to create the loops by carrying the nodes listed in route requesting packet. SMORT doesn't carry the full path in the route requesting packet; because it may extend the network width due to running the big route requesting packet throughout the network. On the other hand, when a number of transferring the route requesting packet is compared, the number of the related route requesting packet is restricted.(several copies of the route requesting packet which move away from destination, don't respond) and they pass on the real paths between source and destination. Finally, if the source receives the first route, it has started to send the packets given to target. When the destination responds to the multiple-path copies of route requesting, the middle nodes may receive the multiple-path route requesting packets; but they distribute only the first responding. Responses are distributed among the adjacent nodes till the nodes receive the previous route requesting packet. Additional answers are released after the nodes carry the copies of secondary routes to their routing table. Maintenance of the route includes two important performances; first, re-connecting between the source and the destination if the paths between them destroyed during the work period; second, removing the routes with ended expiration date from the routing table.

Route discovery phase: if a node wants to communicate with a destination, it starts the **route discovery phase** since it doesn't have any valid route. A right route is a route to a destination which is existed. The lifetime of route entry should consistent with network and the real time. Since the node is properly equipped. The source node writes the target address in a route requesting packet, then distributes it. The structure of the route requesting packet of SMORT is the same as AODV. A middle node receives the route requesting; if there is a route to a destination, it is responded by sending a route requesting packet. Otherwise, route requesting is replayed again. Although, the nodes accept several copies of the route requesting; but the first copy of the route requesting replayed again exclusively. The nodes restore all copies of route requesting in a table called *request-rcvd*. The route requesting information is stored in *request-rcvd* instead of making a reverse route to the source such as AODV. The reserve route may include loops induced by accepting multiple-path requests. Every entry in *request-rcvd* table contains the previous node address that the route requesting is returned to (named previously hop).The number of the route requesting hop pass from the source node. Nodes use this information to return the route requesting packets to the previous source node. if none of the middle nodes doesn't have a certain route to the destination, the destination receives a copy of the route requesting, then it responds to route requesting by itself. **Route responding phase:** route answering is followed by the reverse routes stored in *request-rcvd* table to arrive the source node. Route responding packet used by the SMORT, include 3 additional field excluding the number of field related to AODV responding packet. These additional fields are required to remove the route loops, and can calculate the harmless multiple-paths. When SMORT allows the nodes to accept the multiple-path copies of the route requesting packet ; and additional route requesting packet which is received in the middle node, doesn't return to the source node; here, there will be a route for loops in routes with common terminal(ending).First, we discuss how to form the loops on the routes, then we prove that these loops are removed by SMORT, ultimately. In SMORT, the loops can either be on the main route or on the safe part of it in the loop forms. The loops are not generated on safe parts, singly. Requesting route responds with a route,

[1]Scalable multipath on-demand routing
[2]Ad hoc on-demand distance vector

forms on the main route and enters throughout one or more routes which distributed the requesting route packet, previously. Most of loops generated by the safe parts include two categories. First one has only a node of the main route on the loop. Second one includes continuum multiple-path nodes of the main route on a loop. Among the common continuum multiple-path nodes with the main loops and routes, we consider the first source node as the first loop node and the last node as the last loop node. At SMORT, the main routes and the safe routes are without any loop. So, SMORT doesn't have any loop.

The maintenance phase, the maintenance phase maintains the fixed route for work period during the responding route phase. It sends a data packet for the same destination in every time. The lifetime of nodes on the secondary routes is enough long. This can be decisions based on the frequency of the breaking route due to node mobility and its likely failures. If there is a need for the secondary route before this time, the secondary route has been used for data transmission. While data transmission happens, its lifetime is updated. Otherwise, the secondary routes are removed from the routing table, and their early lifetime expired [3,8].

3 –A Distributed Routing Algorithm Based on Ant Colony (DAR)

DAR is a new self-constructive method for routing algorithm in ad hoc network, called "distributed ant routing". This method belongs to a class of induced routing algorithms which is generated by the behavior of ant colonies to embed and store food. If this method intends to minimum the complexity of the nodes with the cost of optimal solution, it causes to be useful in an environment which needs to communicate quickly and minimum overhead signals. The routing tables are probable in DAR and in every node: the next hop is selected due to probability, and calculated according to remaining pheromone trail excreted by ants. When a node receives a datagram to "d" destination, the datagram is sent providing that the routing entry to "d" is available. Otherwise, the datagram in node is buffered. Sending ants are sent without the constant velocity (exiting ant speed) to search a "d" route. There are two routing methods" hop by hop": The random routing" hop by hop" (Nodes choose a neighbor randomly to give datagram) and the optimal routing" hop by hop" (nodes select the next optimal hop to give datagram). Previous results show excellent results for random routing "hop by hop" in the form of static networks with relatively small topology. However, this method with quick topology changes is not suitable for MANET. Therefore, DAR accepts optimal routing "hop by hop". Front ant is directed due to probabilities of the next hop in routing table of the current node. Thus, sending the front ant is probable and it allows the discovery of available route in the network. Datagram moves cautiously according to the most probabilities from source to target in every middle node. This process creates a complete general route by using local information. We are designing the ant algorithm due to the simplest rules. So we propose that ants store pheromone constantly, while moving. They might be affected by the presence of pheromone in choosing the route. So, the front ants have stored the nodes characteristics watched to prevent the loops. If the front ant has arrived to the destination node, it has generated the poison of the back ant primary; then the poison disappeared. Therefore, the new generated packet is returned to the source, and distributed by the route which is selected by the front ant.

We have designed this ant routing algorithm according to the principle of a maximum simplicity, thus we have assumed that ants can only deposit a constant amount of pheromone while moving and that they can only be influenced by the presence of the pheromone in the path selection. Thus, the forward ants store only the identities of the visited nodes in order to avoid cycles. Once a forward ant gets to the destination node, it first generates a backward ant and then dies. This way, the new packet created and sent back to the source will propagate through the same path selected by the forwardant. As a backward ant travels, it deposits pheromone on the crossed links as described below, updating the routing table of the nodes along the path. Once it has returned to the source node, the backward ant dies.

If j would be Current node; i be the node which the back ant had come from; and τ be a constant and$0 < \tau < 1$Andτ_in be pheromone value in the distance(i, j)after returning "n" back ants toj. In updating process of the pheromone, this value is multiplied with $(1-\tau)$and then τ added till $\tau_i(n+1)$is calculated. The pheromone value on the other links are multiplied with $(1-\tau)$. These similarities restore a constant value of pheromone:

(1) $$\tau_k(n+1) = \begin{cases} \tau_k(n)(1-\tau) + \tau, & k = i, \\ \tau_k(n)(1-\tau), & k \neq i. \end{cases}$$

Probability of choose in the next hop" i" by the front ant is calculated following. We$\text{propose}p_i(n)$as a probability which the front ant choose "i" node as the next hop, after returning the back ant "n". If N would be the neighbor's number, so:

(2) $$p_i = \frac{\tau_i(n)}{\sum_{k=1}^{N} \tau_k(n)}.$$

This shows that the sum of all probabilities related to all valid neighbors is1.Let$y_i(n)$to be a binary variable which equal 1. If the "n"back ant has crossed the distance (i, j), otherwise it would be 0. Let's suppose $\tau_0$to be $\tau_k(0)$fork = 1 ... N. This includes the following formula for the next special hop"i ":

(3) $$\tau_i(1) = \tau_0(1-\tau) + y_i(1)\tau,$$
$$\tau_i(2) = [\tau_0(1-\tau) + y_i(1)\tau](1-\tau) + y_i(2)\tau$$
(4) $$= \tau_0(1-\tau)^2 + y_i(1)\tau(1-\tau) + y_i(2)\tau$$

And in general

(5) $$\tau_i(n) = \tau_0(1-\tau)^n + \sum_{l=1}^{n} y_i(l)\tau(1-\tau)^{n-l}.$$

Pheromone value on the links which move from j after the n back ant returns to j :

(6) $$\tau_{\text{tot}}(n) = \sum_{k=1}^{N} \tau_k(n) = N\tau_0(1-\tau)^n + \sum_{l=1}^{n} \tau(1-\tau)^{n-l}.$$

So:

(7) $$p_i(n) = \frac{\tau_0(1-\tau)^n + \sum_{l=1}^{n} y_i(l)\tau(1-\tau)^{n-l}}{N\tau_0(1-\tau)^n + \sum_{l=1}^{n} \tau(1-\tau)^{n-l}},$$

This could be written as:

(8) $$p_i(n) = M(n) + \sum_{l=1}^{n} y_i(l)\Delta p_l(n),$$

Where

(9) $$M(n) = \frac{\tau_0}{N\tau(0) + \sum_{t=1}^{n} \tau(1-\tau)^{-t}}$$

(10) $$\Delta p_l(n) = \frac{\tau(1-\tau)^{-l}}{N\tau_0 + \sum_{t=1}^{n} \tau(1-\tau)^{-t}}.$$

After then ant returns, the $\Delta p_i(n)$increases the possible $p_i(n)$ by l-returning ants, with $l \leq n$.
Methods in DAR is that, if a routing entry for the destination node*(dest-node)*has a labeled datagram , it is placed with a up flag, then the datagram is sent according to the next hop which stored in routing table. Otherwise, it is buffered in the node. If the label on "IN-REPAR" is set, it means that the ants are researching the best route to destination which they were sent previously. If the flag would be down, it was set on IN-REPAR, so the ants were generated and sent. Send-*request* process or describes the behavior of ants. Note that the node which the ant is generated on (*source-ant-node*) could be different from the source (*source-node*).Also note that the front ant source such as *source-ant-node* and the destination is the source and destination of the returning corresponding ant, respectively. The front ant chooses the next hop due to probabilities related to moving the links of current node. *(Select-link*). Then the crossed node is stored in an array of list-crossednodes. This array is used by the front ant while away from the loops. The next hop is selected just among the current node neighbor which any ant has not seen. In addition, the array is used by the back corresponding ant to find the returning route to (*source-ant-node*).If the back ants arrive to destination, the Recv-Reply process is run. According to this procedure, if the possible threshold condition would be acceptable, or *source-ant-node* have just one neighbor, the rt flag based on up is placed; and buffer datagram in *source-ant-node* is sent according to routing table. Every packet (both ants& datagram) with a lifetime depends on TTL which is greater than 1 for hop of packet. When a node receives a packet, the TTL value is checked. If the TTL value equals 0, the packet is dropped. Additionally, the process of neighbor's management activities runs. Each node remembers a list of neighbors. If a node receives a hello packet from other node located in the list of its neighbors, the expiration timer is updated. If a node within the described distance receives a hello packet from the node which is not its neighbor now, this neighbor is added to list.(The pheromone values and the probabilities related to moving the links of the current node are updated in the process of both cases.) Then the hello packet is released [2,4,11]. Figure 1 shows the algorithm.

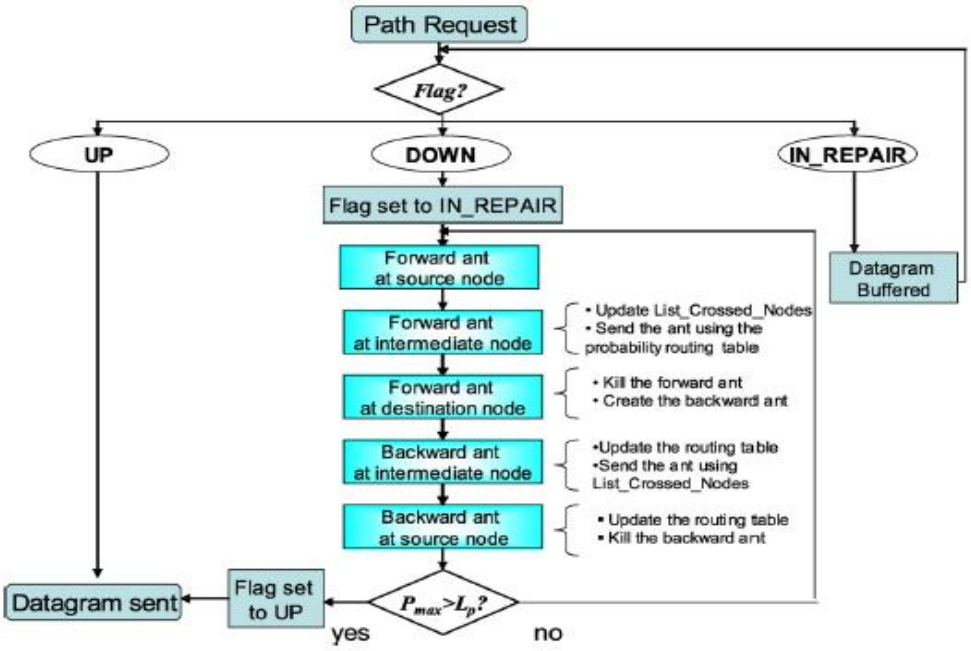

Figure 1

4- Comparing the SMORT and DAR Algorithm

In this part, we compare these two algorithms from the point of view of changing the responding path with the size of network, the stacks which are delivered to destination and general changing finding the path with loading the network. As it shows in figure 2, responding path DAR, SMORT are almost the same in all size of network .logically DAR should be less than SMORT. The sufficiency of accessible in polygamist is lower than non-risk able path and the amount of responding packages are exclusive in every path .but most of the calculation in the DAR path are going to change the result into longer responses, the effect of shorter path will be cancelled in the calculation. The network with longer path, DAR should be before SMORT .because the effect of that in polygamist path become lower, but most of free stacks of these networks reduce the activity of all the path. DAR in comparing to nondisabled path can be more accessible than SMORT. The excess controlled stacks between SMORT and DAR should be increases. statistics shows in figure 3 that how severe plague in accessible path with the size of network in DAR and lack of second path ,the increased overhead result in only one stack delivered to destination .middle nodes which are highly accessible in SMORT ,reduce the path to 50%.this reduction lead to SMORT become twice in nodes.

In figure 4, while the nodes are fixed, both of protocols should show the same propulsion .because there is no breakdown because of dynamic path .when all the 20 circuit are working result in nodes density .the aggregation, increase the glitter and nodes try to resend the erratic stacks. The contacts increase. Finally after resending for maximum time the nodes left the stack .so the receiver get out even if the node has no receiver. Then node send error to resource. Even if the origin path is valid the node finds a new source to reach goal. Although there is the same situation for DAR and SMORT. Node incorrectly presume that the path breaks and use second path to send the stacks .while the locomotion increase the protocol conduct usually .the amount of free stacks in this protocol increase because of several breaks in path with high speed .in SMORT some of the

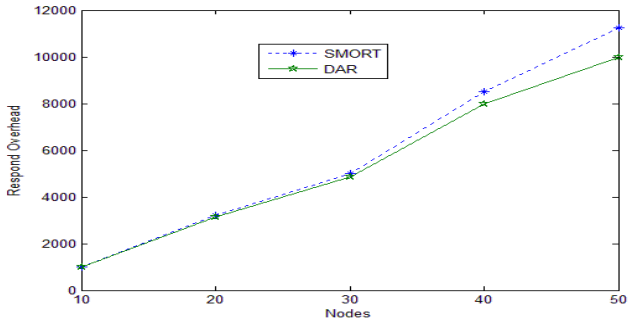

Figure 2

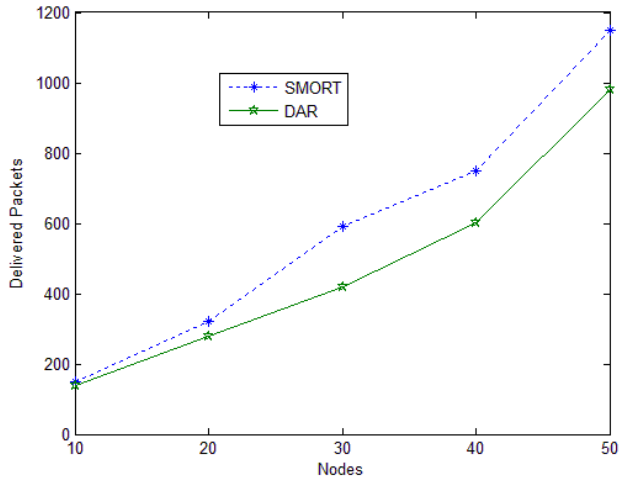

Figure 3

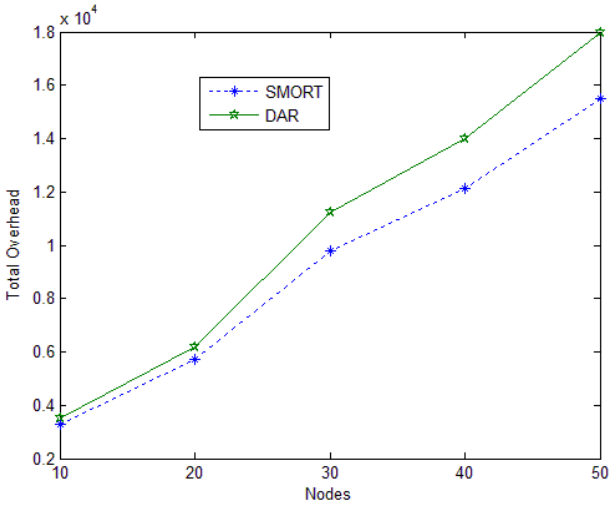

Figure 4

Second path slacks the high speeds and the nodes of source find new way .but DAR and SMORT growth higher for using second path. DAR has lower implementation than SMORT. Simulation results are shown in table 1.

Table 1: Comparing result SMORT and DAR

Node	Respond Overhead		Delivered Packets		Total Overhead	
	SMORT	DAR	SMORT	DAR	SMORT	DAR
10	1500	1480	180	175	3820	3800
20	3800	3760	315	280	6030	5987
30	5200	5050	590	410	9800	11700
40	8060	7890	720	570	11670	13200
50	11200	9900	1180	990	14350	18000

5-Conclusion

According to previous comparison packet delivery ratio in the DAR algorithm is more than SMORT. Because ant algorithm, after a certain route discovery process begins again so it is time consuming but because smart algorithm has secondary rout ;if the rout cut off it sends the packet via secondary path. In DAR routing table is possible (based on the amount of pheromone). This means that next hop in terms of probability of selection is chooses and if the rout is cut off it should seek the rout from the first but in SMORT the rout discovery is decisive. In DAR error message is not needed.In fact, if a node sends a packet to the request routing table, Nodes start searching for a new route by sending front ants. In SMORT if the path cuts off, it sends an error message to source node. DAR does not use sequential numbers for discovery routing And

recently paths which are not used are removed by evaporation of the pheromone but in SMORT each entry routing has sequential numbers that suggests which rout it used and it could update it.in SMORT the routs are not removed because there is rout number in rout discovery table. According to the results, DAR can be in an environment that requires rapid communication and signaling overhead is minimized; While SMORT can be used very widely in networks.in SMORT routing overhead is low and because of secondary path the reliability of this method in conducting packets to destination is very high.

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REFRENCES

[1] Mahmood H., Comaniciu C., Interference aware cooperative routing for wireless ad hoc networks, Department of Electrical and Computer Engineering, Stevens Institute of Technology, Castle Point on Hudson,Hoboken, NJ 07030, United States, Ad Hoc Networks, PP 248–263, (2009).

[2] Laura Rosati ,MatteoBerioli, GianlucaReali, On ant routing algorithms in ad hoc networks with critical connectivity, Ad Hoc Networks,Volume 6, Issue 6, Pages 827–859, (2008).

[3] L. Reddeppa Reddy, S.V. Raghavan, SMORT: Scalable multipath on-demand routing for mobile ad hoc networks, journal of Ad Hoc Networks, PP 162–188, (2007).

[4] Wang J., Osagie E., Thulasiraman P., HOPNET: A hybrid ant colony optimization routing algorithmfor mobile ad hoc network, Department of Computer Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2, Ad Hoc Networks,PP 690–705, (2009).

[5] Caro G.,Ducatelle F., Gambardella L.M., AntHocNet: an adaptive nature inspired algorithm for routing in mobile ad hoc networks, European Transactions on Telecommunications (Special Issue on Self-Organization in Mobile Networking) 16 (2) (2005).

[6] Samar P., Perlman M., Zygmunt J, Independent zone routing: an adaprive hybrid routing framework for ad hoc wireless networks, IEEE/ACM Transactions on Networking 12 (4) (2004).

[7] Yi J., Adnane A., David S., Parrein B., Multipath optimized link state routing for mobile ad hoc networks, Université de Nantes, Nantes AtlantiqueUniversitésIRCCyN, CNRS UMR 6597, Polytech'Nantes, rue Christian Pauc, BP50609, 44306 Nantes cedex 3, France, Ad Hoc Networks,(2010) .

[8] Tarique M., Tepe K.E., Adibi S., Erfani S., Survey of multipath routing protocols for mobile ad hoc networks, Journal of Network and Computer Applications 32,PP 1125–1143,(2009).

[9] HosseiniNazhadghazani, S.H., JabariLotf. J., Transmit Power Control Algorithms in Ad hoc Networks, Journal of Basic and Applied Scientific Research, PP 2648-2654, (2011).

[10] Naseer, S., Hussain. S.A., Raza. I., Chaudry. S.R.,,Mirza. J.S, Raza. M.H., Mobile Ad-hoc Network Routing Protocols: A Simulation and Performance Analysis Using Multimedia Traffic, Journal of Basic and Applied Scientific Research, PP 9925-9930, (2012).

[11] Nishitha. T., Reddy. P.C.,Performance Evaluation Of AntHoc Net Routing Algorithm in Ad Hoc Networks, IEEE International Conference on Computing Sciences, (2012).

[12] Li. ZH., Yu. A.J., A Hybrid Routing Algorithm based on Overlay Network for Wireless Ad Hoc Network, IEEE International Conference on Industrial Control and Electronics Engineering, (2012).

[13] Kumar. S., Chaudhary.R., Nitin., Optimization of Routing Algorithms in Ad-hoc Networks using Swarm Intelligence, IEEE World Congress on Information and Communication Technologies, (2011).

[14] Limin. M., Wenbo. S., Routing Protocol Based on Grover's Searching Algorithm for Mobile Ad-hoc Networks, Network Technology and Application, PP 145-156, (2013).