International Journal of Electronics Engineering Research.
ISSN 0975-6450 Volume 9, Number 1 (2017) pp. 105-119

http://www.ripublication.com

Impact of Mobility and Terrain Size on Performance of Hybrid Routing Protocol in Mobile Adhoc Network

Surinder Singh[1], BS Dhaliwal[2], Rahul Malhotra[3], Mahendra Kumar[4]

[1]Research Scholar, GKU, Talwandi Sabo, Punjab, India.
[2]VC, GKU, Talwandi Sabo, Punjab, India.
[3]Director-Principal GTBKIET, Malout, Punjab, India.
[4]Deputy Dean Research, Talwandi Sabo, Punjab, India.

Abstract

A Mobile Ad hoc Network (MANET) is formed from the collection of a number of wireless mobile devices without having any fixed infrastructure. In this paper work, authors have implemented advanced protocol by combining DSR and AODV protocols to enhance the performance of Routing Protocols .Simulation is carried out to check the Performance of Protocol in terms of Packet Delivery Ratio, Throughput, Average End to End Delay , Routing Overhead and Energy Consumption for different Terrain Size and Node mobility. The simulations are carried out by using MATLAB.

Keywords: Routing Protocols, MANET, DSR, AODV, Hybrid, MATLAB.

INTRODUCTION

An Ad hoc network is a wireless and infrastructure less network. A mobile ad hoc network (MANET) is formed from the collection of a number of wireless mobile devices without having any fixed infrastructure. Here each node can work as a source, destination or routing node. The nodes in MANET allowed moving freely in random pattern. The mobility and transmission power of mobile nodes plays an important role on performance of MANET routing protocols [1]. In reactive routing protocols, source sends route discovery through the network only when the route is required. Dynamic Source Routing (DSR) and Ad hoc On-Demand Distance Vector (AODV) comes under the category of reactive Protocols [2]. MANET could be deployed in applications such as search and rescue, automated battlefields, disaster recovery, intelligent transportation and sensor networks [3]. A basic hypothesis in ad-hoc networks is that each node can be used to send data packets among arbitrary sources and destinations. Hence, some kind of routing protocol is required in order to make routing decisions. Many problems such as mobility and limited bandwidth are introduced in a wireless ad-hoc environment which makes routing complicated [4] .Dynamic topology, asymmetric links, routing overhead and interference are challenges that make routing in mobile ad hoc networks a difficult task [5] .The performance analysis of MANET depends on the routing scheme employed. Various routing protocols have been discussed so far to improve the routing performance and reliability. On Demand MANET Routing protocols are considered to perform better than proactive protocols in highly dynamic and robust networks, therefore they are best suited to be tested against topologies with inconsistent densities. On Demand MANET protocols AODV and DSR still suffer some short coming problems due to longer set up time in case of link failure and scalability problem due to more routing overhead. Conventional routing protocols do not work efficiently in a MANET. In MANET, Energy efficient routing protocols are the only solution to cope up with above circumstances. Most of the existing work of making protocols energy efficient has been done on " On demand routing protocols" because these protocols are more energy efficient rather than proactive protocols but still these have some problems [6] . For the optimum performance, it is necessary that all the nodes in the network cooperate with others because these nodes have limited resources like limited memory and battery power.

AODV ROUTING PROTOCOL

In this protocol each node maintains routing information in the form of a routing table having one entry per destination [1]. AODV uses the destination sequence number to guarantee the route freshness and loop freedom of the route [2]. Four types of control messages are used in AODV Routing protocol. Route Request (RREQ) and Route Reply (RREP) messages are used for route finding. Route Error (RERR) messages and HELLO messages are utilized for route repairs [10]. Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol used for calculation of multiple loops free and link disjoint routes. It is an extension to the AODV protocol. AOMDV faced with more message overheads because it is a multipath routing protocol and the destination has to reply to the multiple RREQs [4]. Used algorithm consists of two steps: route discovery and route maintenance. Route discovery process begins when one of the nodes wants to send packets. Node sends Route Request (RREQ) packets to its neighbors. Neighbors return RREP packets if they have corresponding route to destination. However, if they don't have corresponding route, they forward RREQ packets to their neighbors, except the origin node. Also, they use these packets to build reverse paths to the source node. This process occurs until a route has been found [5]. Every mobile node maintains a next hop routing table, which contains the destinations to which it currently has a route. The reactive property of the routing protocol implies that it only requests a route when it needs one [9] .If an intermediate node is unable to forward the packet to the next hop or destination due to link failures, it generates the route error (RERR) message by tagging it with a higher destination sequence number. When the sender node receives the RERR message, it initiates a new route discovery for the destination node [15].

DSR ROUTING PROTOCOL

DSR uses 'source routing' i.e. the senders node knows the complete hop-by-hop route to the destination and these routes are stored in its route-cache. [1]. When the destination is not known, node caches the packet and finds the routing information to the destination by sending route queries to all nearby nodes. Then it sends the Route-Replies back to the source [2] .Therefore, bandwidth overhead reduces, battery power conserves and large routing updates will be avoided. The DSR routing protocol uses two major mechanisms to discover routes and maintain the route information from one node to another. In DSR each packet carries all information related to route in its header. Therefore, the intermediate nodes are permitted to accumulate the route information in their routing tables for future usage [4] .If a node has to send a packet to another one, and it has no route, it initiates a route discovery process. This process is similar to AODV route discovery process. In other words, the network is being flooded with RREQ packets [11]. Each node that receives RREQ packet, broadcasts it, except for destination node or nodes that have route to destination node in their memory [13]. There can be multiple RREP packets on one RREQ packet. In DSR, when broken link is detected, RRER packet is sent backward to the source node. After receiving RREP packet, source node initiates another route discovery operation. Additionally, all routes containing the broken link should be removed from the route caches [12]. Additionally, DSR protocol aggressively uses source routing and route caches. The route discovery in DSR is performed by flooding the network with RREQ packets. However, the major difference is that the RREQ packet contains a route record in this protocol. While the RREQ traverses the intermediate nodes, each node performs a cache check to examine, if it has a route to the destination; if it does not, it appends its own address in the route record and forwards the packet to the next node. Once the RREQ packet reaches the destination or an intermediate node that has the destination route, it generates a RREP message, which contains the route record of the RREQ including the addresses of the intermediate nodes. Therefore, the source node will possibly receive many RREP packets from different nodes containing multiple routes to the destination. The DSR protocol selects one of these routes, which constitutes the shortest one and caches the others in case of a link failure. Towards avoiding RREQ packets from permanently travelling in the network, DSR allows those nodes that have already dealt with a RREQ message to reject any further RREQ regarding the same source node [7]. One big advantage is that intermediate nodes can learn routes from the source routes in the packets they receive. Finally, it avoids routing loops easily because the complete route is determined by a single node instead of making the decision hop-by-hop [9]. If any link of this route is broken, the source node is informed by a route error (RERR) packet and this route is discarded from cache. Intermediate nodes store the source route in their cache for possible future use [14].

PROPOSED WORK

The environment is created for transferring the data from one place to another for different network size. 200 nodes have been given as an input. Xlocs and Ylocs are being found out with-in a network. Randomly, source and destination nodes have been chosen from the nodes. Initiate the coverage area i.e., 20 % of the width of the network to find to coverage set for each node. On the basis of DSR, the path is being found based on the nearest neighbor node. In DSR Routing approach, source node send packet to destination node to get the route from source to destination. It contains request_id which is unique and record listing of the address for each intermediate node.. Destination node of the route discovery returns the RREP message to the source node. When the source node received RREP, it records this route in the route cache. Before sending packets, node saves the copy of original packet in a local buffer. In route maintenance, source node detects another route towards the destination if the network topology change or existing link breaks as network grows. When a route breaks due to node mobility or node failure, flat routing protocols like DSR and AODV typically discard the whole original route and initiate another round of route discovery to establish a new route from the source to the destination. When a route breaks, usually only a few hops are broken, but other hops are still intact. Thus, traditional approach wastes the knowledge of the original route and may cause significant overhead in global route discoveries. An optimization of Protocol is based on shortest and reliable path to destination and local repair of path during link break due to mobility of nodes. After that, initialize AODV routing algorithm. The area of DSR is given to area of AODV and the xlocs and ylocs of DSR is transferred to xlocs and ylocs of AODV. The speed parameters are configured further 10m/s or 50 m/s. AODV is combined with DSR routing protocol i.e. named as HYBRID Routing Protocol which can be created by modifying the path of DSR routing protocol on the basis of energy consumption parameter. Except source and destination nodes, all the energy parameters of nodes would be selected of the path. A node is finding out which has less energy consumption as compared to path node within the coverage area of its previous and next node of path. Now, path node would be replaced by this node and this process will be applied to rest of the nodes of path. With this, a path is generated with less energy consumption. With the new path, data transferred is performed and the QoS parameters evaluated.

SIMULATION ENVIRONMENT AND PERFORMANCE METRICS

A. Simulation Environment

For the performance analysis of HYBRID, we have used MATLAB as the network simulator. The mobility model we have chosen is Random Way Point model. The other parameters that we have chosen for the network in the simulator are as listed in the table

Table 1. Simulation Parameters

PARAMETERS	USED IN SIMULATION
Simulator	MATLAB(2010)
Channel type	wireless channel
Antenna type	Omni Antenna
Radio-propagation model	two ray ground
Mac type	Mac/802.11
Protocols studied	Hybrid Protocol
Simulation area	500m×500m.,1000m×1000m,1500m×1500m
Transmission range	250m
Node movement model	Random waypoint
Traffic type	CBR(UDP)
Packet size	512 Bytes
Number of nodes	Maximum 200
Node Speed	10m/s and 50m/sec

B. Performance Metrics

The performance is measured on the basis of some parameters which are described as follows:

Packet delivery ratio: The ratio between the number of packets originated by the CBR sources and the number of packets received at the final destination. It describes the loss rate seen by the protocol.

Throughput: It is defined as total number of packets received by the destination. It is a measure of effectiveness of a routing protocol. Throughput is the amount of data transferred over the period of time expressed in kilobits per second (Kbps).

Avg. End-to-End Delay: Average amount of time taken by packets to go from source to destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission on delays at MAC, and propagation and transfer times.

Routing overhead: The total number of routing packets transmitted during the simulation. If control and data traffic share the same channel, and the channels capacity is limited, then excessive control traffic often impacts data routing performance. This is the ratio between the total control packets generated to the total data packets during the simulation time.

Energy Consumption: Energy consumption of a node is mainly due to the transmission and the reception of data or controlling packets. To measure this amount of energy consumed during the transmission process (noted Tx Energy), we should multiply the transmission power (Tx Power) by the time needed to transmit a packet.

SIMULATION RESULTS AND ANALYSIS

In this section we present the simulation results for HYBRID routing protocol along with a detailed Analysis of the performance. The analysis is based on the comparison of different terrain area .For the analysis we have considered the metric for the different terrain area, varying numbers of nodes with node speed 10m/s and 50m/s.

1) Small Terrain Area-

Analysis is based on small terrain area (500mx500m) with 200 number of nodes with node speed 10m/s and 50m/s for different performance metrics ,which are shown in fig 1(a,b,c,d,e). As no. of nodes increase, packet delivery ratio decreases. Cause of decrease of packet delivery ratio is due to network congestion. At high mobility, packet delivery ratio decrease due to more link break. Throughput also decreases as number of nodes increases. At lesser number of nodes and at low speed throughput is high. End to End delay is more for high speed. Routing overhead for low speed is low and for more speed it is high and remains almost constant over the entire node density. It is due to the excellent property of Routing Protocol to find the alternate route locally in case of link failure. Energy consumption increases as number of nodes increases.

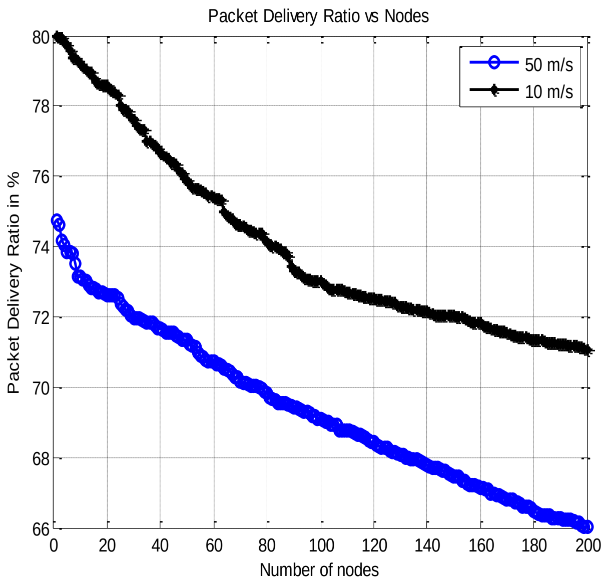

Fig.1 (a) Packet delivery ratio vs. no. of nodes for speed 10m/s and 50m/sec for terrain area500mx500m

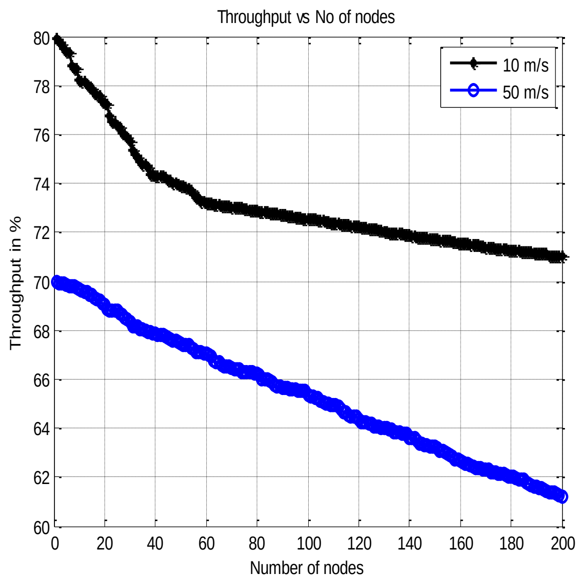

Fig.1 (b) Throughput vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area500mx500m

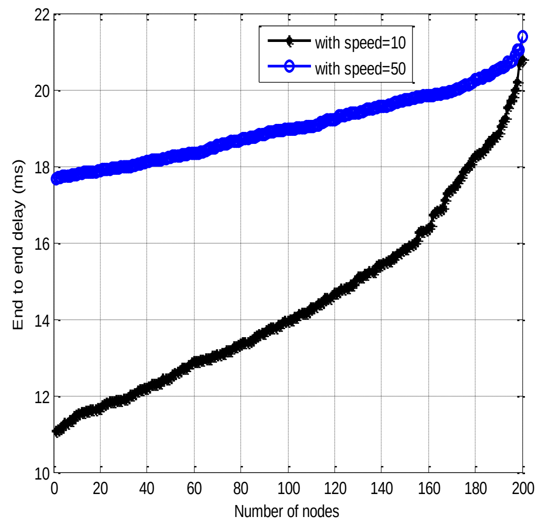

Fig.1 (c) end to end delay vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area500mx500m

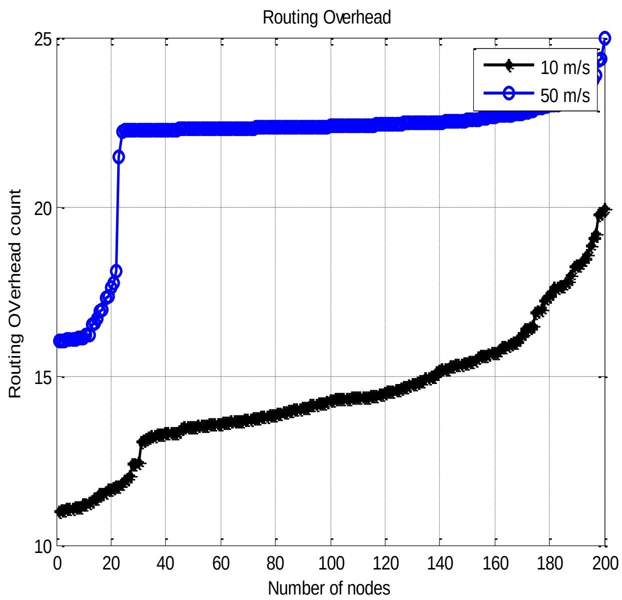

Fig.1 (d) routing overhead vs. no. of nodes for speed10m/s And 50m/ sec for terrain area500mx500m

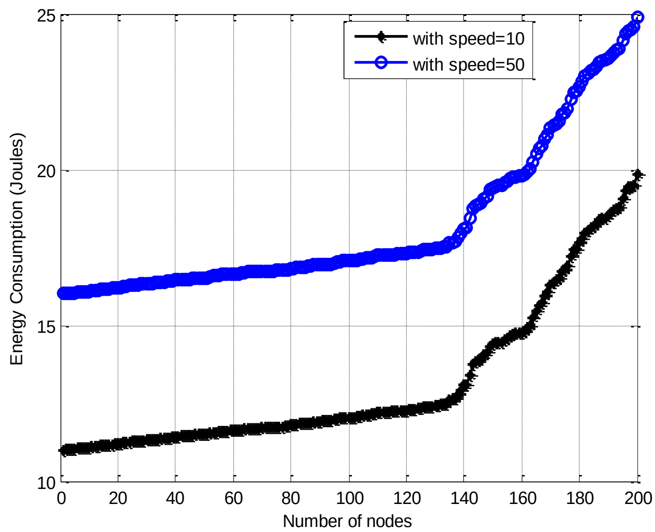

Fig.1 (e) Energy consumption vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area500mx500m

2) Medium Terrain Area-

Analysis is based on medium terrain area (1000mx1000m) for 200 number of nodes with node speed 10m/s and 50m/s for different performance metrics as shown in fig 2(a,b,c,d,e). Packet delivery ratio increases in comparison to small terrain area. Throughput also improved for low and high speeds in comparison to small terrain area. Routing overhead and energy consumption also improved in comparison to small terrain area. This improvement is due to less Network congestion.

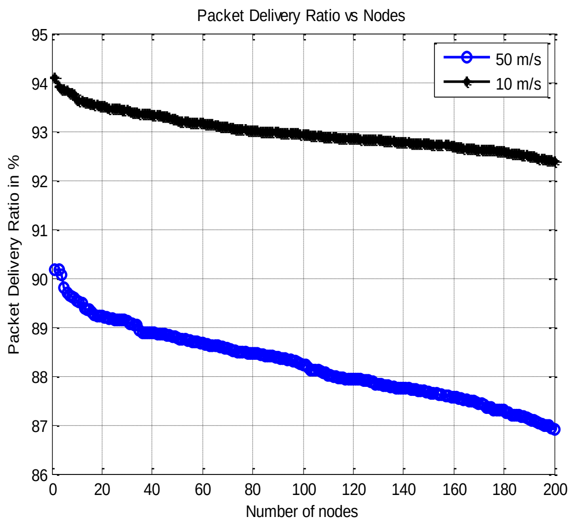

Fig.2 (a) Packet delivery ratio vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area1000mx1000m

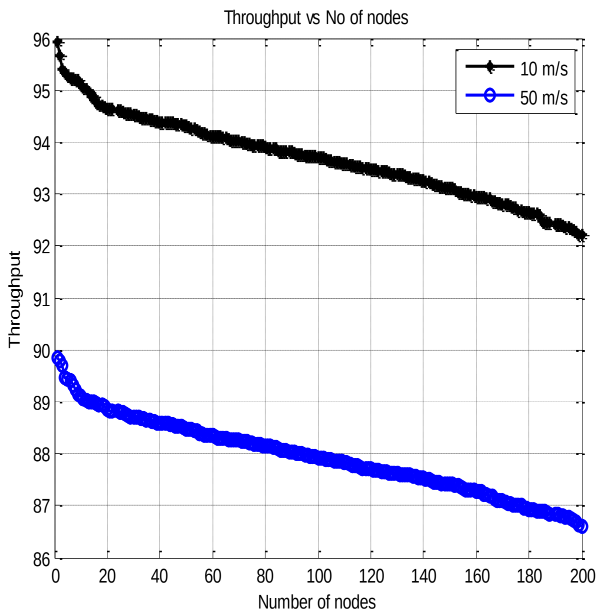

Fig.2 (b) Throughput vs. no. of nodes for speed 10m/s and 50m/sec for terrain area1000mx1000m

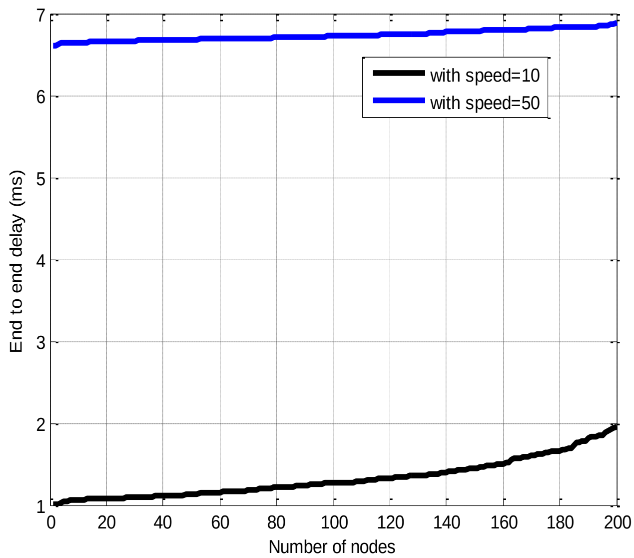

Fig2(c) End to End Delay vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area1000mx1000m

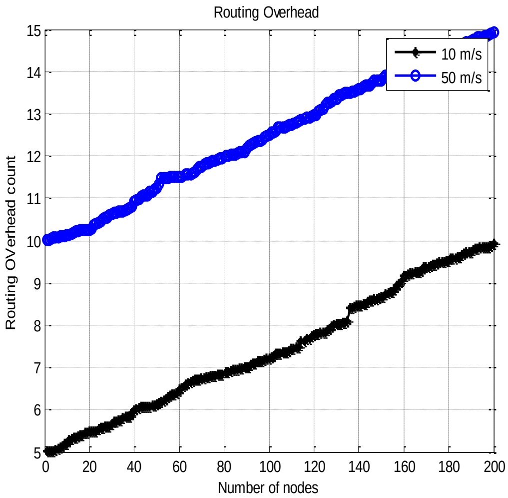

Fig.2 (d) Routing overhead vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area1000mx1000m

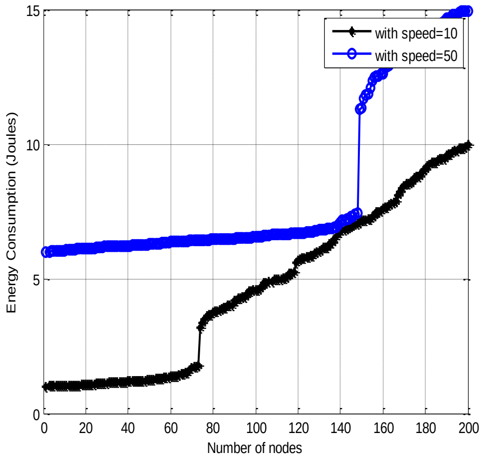

Fig.2 (e) energy consumption vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area1000mx1000m

Large Terrain Area-

Analysis is based on large terrain area (1500mx1500m) for 200 number of nodes with node speed 10m/s and 50m/s for different performance metrics as shown in fig 3(a,b,c,d,e,f). Packet delivery ratio and Throughput decreases in comparison to medium terrain area. End to End delay increases in comparison to medium terrain area. End to End delay increases as number of nodes and node speed increases. It is due to time spending to find alternate route in case of link failure at high speed.

Routing overhead and energy consumption also detoriate in comparison to medium terrain area.

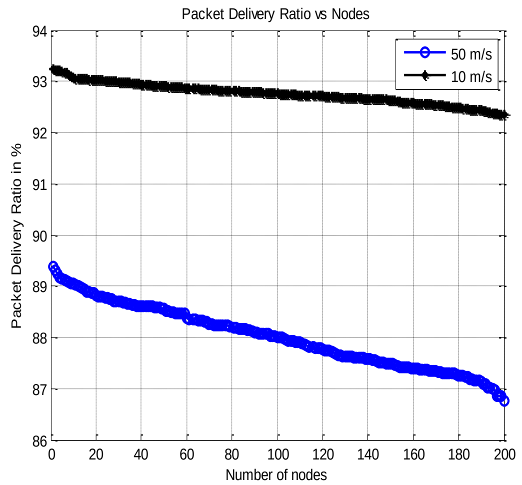

Fig.3 (a) Packet delivery ratio vs. no. of nodes for speed 10m/s and 50m/sec for terrain area1500mx1500m

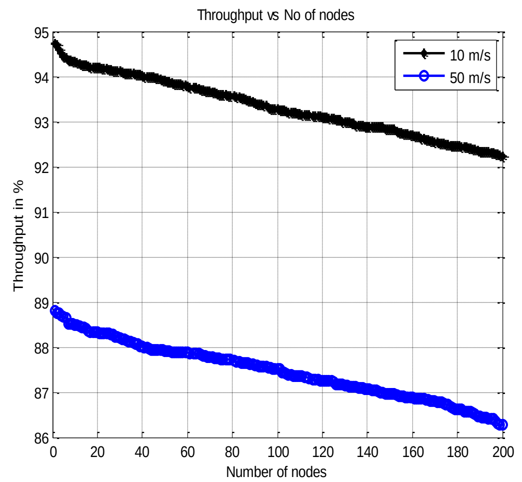

Fig.3 (b) Throughput vs. no. of nodes for speed 10m/s and 50m/sec for terrain area1500mx1500m

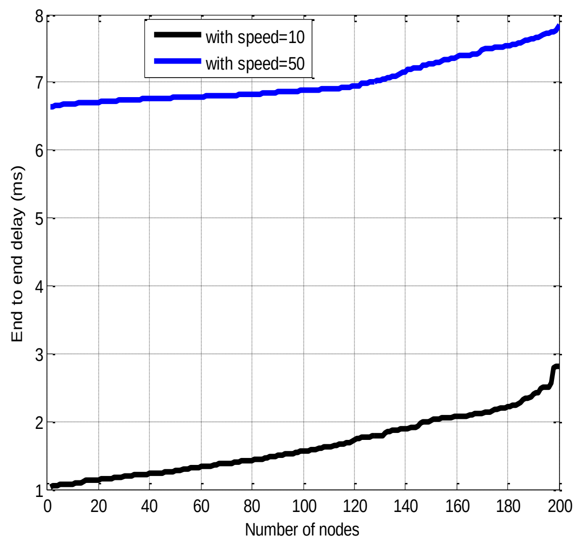

Fig.3 (c) end to end delay vs. no. of nodes for speed 10m/s and 50m/ For terrain area1500mx1500m

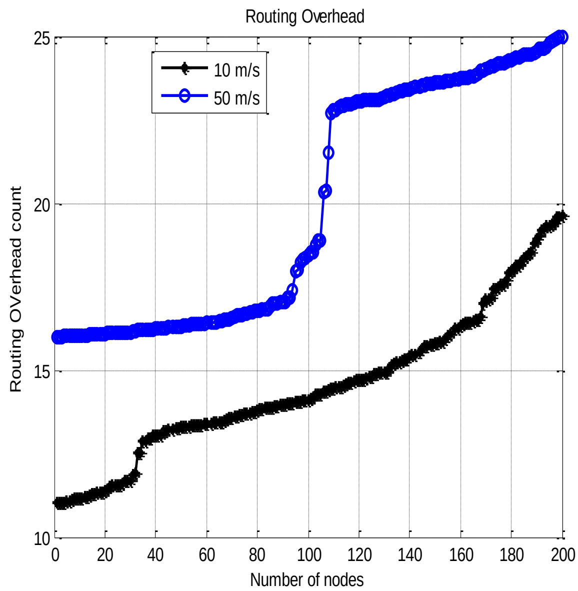

Fig.3 (d) routing overhead vs. no. of nodes for speed 10m/s and 50m/sec for terrain area1500mx1500m

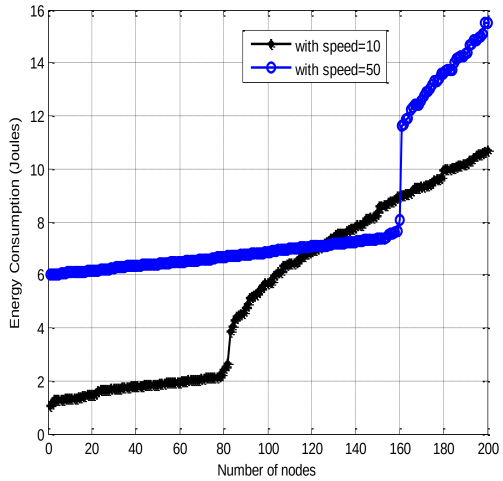

Fig.3 (e) energy consumption vs. no. of nodes for speed 10m/s and 50m/ sec for terrain area1500mx1500m

CONCLUSION

In this work, performance of HYBRID Reactive routing protocol in mobile ad hoc networks has been studied and evaluated by using MATLAB. HYBRID protocol is implemented using DSR and AODV Routing Protocols. Performance carried out in terms of packet delivery ratio, Throughput, end to end delay, routing overhead and energy consumption for different Terrain area and node mobility. From the analysis, it is observed that packet delivery ratio, throughput decreases as node density and node speed increases. End to End Delay and Energy consumption increases as number of node and node speed increases. We found a impact of terrain area and node speed on the performance of network. Simulation results show that HYBRID Protocol works well for Medium terrain area .Our future work is to analyze and enhance the performance of Reactive Routing protocol by considering more attributes and different mobility models of network

REFERENCES

[1] Banoj Kumar panda, Janmejaya Swain, Durga Prasad Mishra, Benudhar Sahu, "Analysis of effect of Mobility and Transmission power on AODV and DSR in Mobile Adhoc Network, " ***ieee**xplore* , October *2014* .

[2] Mehdi Barati, Kayvan Atefi, Farshad Khosravi and Yashar Azab, "Performance Evaluation of Energy Consumption for AODV and DSR Routing Protocol in MANET," International Conference on Computer and information Science, IEEE, 2012.

[3] N. Adam, M.Y. Ismail, J. Abdullah, "Effect of Node Density on Performances of Three MANET Routing Protocols,'' *ieeexplore,* 2010.

[4] Tanya Koohpayeh Araghi, Mazdak Zamani, Azizah Abdul Mnaf, "Performance Analysis in Reactive Routing Protocols in Wireless Mobile Ad Hoc Networks Using DSR, AODV and AOMDV ,"International Conference on Informatics and Creative Multimedia, IEEE, pp 81-84, 2013.

[5] Sabina Barakovi, Jasmina Barakovi, " Comparative Performance Evaluation of Mobile Ad Hoc Routing Protocols,'' MIPRO, May, 2010, Opatija, Croatia.

[6] Bhabani Sankar Gouda, Ashish Kumar Dass, K.Lakshmi Narayana, "A Comprehensive Performance Analysis of Energy Efficient Routing Protocols in different traffic based Mobile Ad-hoc Networks," ieeexplore, 2013.

[7] Michalis Papadopoulos, Constandinos X., Georgios Skourletopoulos, "Performance Analysis of Reactive Routing Protocols in Mobile Ad hoc Networks," ieeexplore, 2014.

[8] Hannan Xiao, Dashti M. Ibrahim and Bruce Christianson, "Energy Consumption in Mobile Ad Hoc Network, WCNC'14 Track 3 (Mobile and Wireless Networks),'' ieeexplore, 20 November 2014.

[9] Satveer Kaur, "Performance Comparison of DSR and AODV Routing Protocols with Efficient Mobility Model in Mobile Ad-Hoc Network,"IJCST, Vol. 2, Issue 2, June 2011.

[10] Dependra Dhakal, Kiran Gautam, "Performance Comparison of AODV and DSR Routing Protocols in Mobile Ad- hoc Networks," International Journal of Engineering Science and Innovative Technology (IJESIT), Volume 2, Issue 3, May 2013.

[11] S.R. Biradar, "Analysis of QoS Parameters for MANETs Routing Protocols," International Journal on Computer Science and Engineering, Vol. 02, No. 03, 2010, pp593-599.

[12] Sahil Gupta, Sunanda Arora, Gaurav Banga, "Simulation Based Performance Comparison of AODV and DSR Routing Protocols in MANETS," International Journal of Applied Engineering Research, Vol.7 No.11, (2012).

[13] Surinder Singh, "Impact of Node Density and Mobility on Performance of DSR Routing Protocol in Mobile Ad hoc Network," International Journal of Advanced Research in Computer Science, Volume 7, No. 1, January-February 2016.

[14] Surinder Singh, "Performance Evaluation of DSR Reactive Routing Protocol in Wireless Mobile Ad Hoc Networks,"19th Punjab science congress conference, January, 2016.

[15] Surinder Singh, "Performance Analysis of AODV Routing Protocol in Mobile ADHOC Networks," International Journal of Advance Research in Computer Science and Management Studies, Volume 4, Issue 1, January 2016.