www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 5 Issue 5 May 2016, Page No. 16478-16486

Optimum Route Selection & Modified Network Approach to optimize Power aware Routing in MANET

***Nikita Yadav*[1], *Abhishek Sharma*[2]**
yadavnikita1612@gmail.com, abhi.sbit@gmail.com

[1] Research Scholar,SBIT,Sonipat,131001,Hayana,India
[2]Assistant-Professor,SBIT,Sonipat,131001,Haryana,India

Abstract: Energy consumption is a significant issue in ad hoc networks since mobile nodes are battery powered. In order to prolong the lifetime of ad hoc networks, it is the most critical issue to optimize the energy consumption of nodes. In this paper, we propose a power aware routing protocol for choosing energy efficient optimum route selection & network approach. This system also considers transmission power of nodes and residual energy as energy metrics in order to maximize the network lifetime and to reduce energy consumption of mobile nodes. The objective of our proposed system is to find an optimal route based on two energy metrics while choosing a route to transfer data packets. This system is implemented by using NS-2.35. Simulation results show that the proposed routing protocol E-EPAR with transmission power and residual energy control mode can extend the life-span of network and can achieve higher performance when compared to EPAR and DSR routing protocols.

INDEX TERMS: - MANETs, EPAR, DSR, E-EPAR, NS.

I. Introduction

A MANET (Mobile ad hoc network) is multi-hop wireless network that consists of mobile nodes that communicate via direct path or multi-hop wireless links in the absence of fixed infrastructure. Mobile Ad-hoc network is multi hop wireless network that are communicate between two mobile nodes treated as indistinguishable no matter what is the distance between these nodes. Energy conservation is the most important issues in ad hoc networks The nodes of these networks have several constraints such as limited bandwidth, transmission range and processing capability due to which the network working has to be fully decentralized i.e. message processing or message passing must be done by nodes themselves using certain protocols is to be use in a lot of practical applications, including personal area networks,(PAN) home area networking, military environments, and search a rescue operations. The wide range of applications has led to a recent rise in research work and development activities. Efficient energy conservation plays an important role in the performance of MANET routing because mobile host in such networks are usually battery-operated. Recently, some of energy efficient routings have been proposed, but most of them consider energy conservation in a static or relative static state. This work coordinated considers the stability of link and remaining power of node to be utilized. Each node in MANET utilizes its limited residual battery power for its network operations. Therefore conservation of battery power is a crucial aspect for researchers in MANET. Several researchers even today are working in this direction to conserve battery. Several mechanisms have been proposed to conserve battery power such as utilizing variable transmission range of radios, minimizing the number of hello broadcasts packets. In addition to its research area on conserving battery power using routing schemes is still going on. Various power aware routing protocols that are used for to extending the battery lifetime such as Minimum Total Power Routing Protocol (MTPR), Minimum Battery Cost Routing Protocol [MBCR], Power-Aware

Source Routing Protocol, Localized Energy Aware Routing Protocol, Online Power Aware Routing protocol, Power Aware Localized Routing protocol and Power Aware Routing Protocol. This paper considers MTPR routing protocol and tries to avoid those nodes whose residual energy is too low. In addition we are trying to compares the performance of both these protocols on various performance metrics such as hop count, throughput, path optimality etc. The result shows an impact variations or improvement when nodes with residual low energy are avoided from path.

Applications of MANETs.

Military Scenarios: MANET supports tactical network for military communications and automated battlefields.

Rescue Operations: It provides Disaster recovery, means replacement of fixed infrastructure network in case of environmental disaster.

Data Networks: MANET provides support to the network for the exchange of data between mobile devices.

Device Networks: Device Networks supports the wireless connections between various mobile devices so that they can communicate.

Free Internet Connection Sharing: It also allows us to share the internet with other mobile devices.

Sensor Network: It consists of devices that have capability of sensing, computation and wireless networking. Wireless sensor network combines the power of all three of them, like smoke detectors, electricity, and gas and water meters.

II. LITERATURE REVIEW

Shivashankar and GollaVaraprasad, "Designing Energy Routing Protocol with Power consumption optimization in MANET" proposed an efficient power aware routing (EPAR), a new power aware routing protocol that increases the network lifetime of MANET. In contrast to conventional power aware algorithms, EPAR edentates the capacity of a node not just by its residual battery power, but also by the expected energy spent in reliably forwarding data packets over a specific link. Using a mini-max formulation, EPAR selects the path that has the largest packet capacity at the smallest residual packet transmission capacity. This protocol must be able to handle high mobility of the nodes that often cause changes in the network topology.

V. Rishiwal et. al., "QoS based power aware routing in MANETs", proposed that QoS based power aware routing protocol (Q-PAR) is proposed and evaluated that selects an energy stable QoS constrained end to end path. The selected route is energy stable and satisfies the bandwidth constraint of the application. The protocol Q-PAR is divided in to two phases. In the first route discovery phase, the bandwidth and energy constraints are built in into the DSR route discovery mechanism. In the event of an impending link failure, the second phase, a repair mechanism is invoked to search for an energy stable alternate path locally. Simulation was performed to determine the network lifetime, throughput and end to end delay experienced by packets and for other parameters.

Hussein Al-Bahadili, "**Enhancing the Performance of Adjusted Probabilistic Broadcast in MANETs",** optimization mechanism to alleviate the effect of broadcast storm problem during route discovery and other services in mobile ad hoc networks (MANETs). In current dynamic probabilistic algorithms, the retransmission probability of the intermediate nodes is expressed as a function of the first-hop neighbors.

Perkins et. al., "A survey of QoS routing solutions for mobile ad hoc networks" provide brief discussion on a survey of routing solutions for mobile ad hoc networks. In mobile ad hoc network the provision of quality of service guarantees is much more challenging than in wire line networks, mainly due to node mobility, multi-hop communications contention for channel access, and a lack of central coordination. Guarantees are required by most multimedia and other time- or error-sensitive applications.

III. DESIGN & IMPLEMENTATION

It proposes a novel scheme to calculate the rebroadcast delay. The rebroadcast delay is to determine the forwarding order. The node which has more common neighbors with the previous node has the lower delay. If this node rebroadcasts a packet, then more common neighbors will know this fact. Therefore, this rebroadcast delay enables the information that the nodes have transmitted the packet spread to more neighbors, which is the key to success for the proposed scheme. Moreover, proposes a novel scheme to calculate the rebroadcast probability. The scheme considers the information about the uncovered neighbors (UCN), connectivity metric and local node density to calculate the rebroadcast probability. The rebroadcast probability is composed of two parts. Additional coverage ratio, which is the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors; and connectivity factor, which reflects the relationship of network connectivity and the number of neighbors of a given node. It proposes a new perspective for broadcasting not to make a single broadcast more efficient but to make a single broadcast more reliable, which means by reducing the frequency of upper layer invoking flooding to improve the overall performance of flooding. In our protocol, we also set a deterministic rebroadcast delay, but the goal is to make the dissemination of neighbor knowledge much quicker.

Advantages

- Reducing routing overhead due it generates less rebroadcast traffic
- Optimizing the power.
- Less redundant rebroadcast mitigates the network collision and contention
- Better packet delivery ratio

MODULE 1

Determination of Common neighbors

Initially, each node in the network sends the beacon packets to each node in the communication range. A node which receives the beacon packet replies to the sender including its information. Thus, each node maintains the neighbor list frequently. A source node sends the RREQ packet to its neighbors, when it initiates the route discovery process. A node which receives the RREQ packet, it compares the neighbor list with its sender neighbor list. And, it determines the common neighbors.

MODULE 2

Rebroadcast Delay and Timer

If node ni has more neighbors uncovered by the RREQ packet from s, which means that if node ni rebroadcasts the RREQ packet, the RREQ packet can reach more additional neighbor nodes. In the proposed work, define the UnCovered Neighbors set U(ni) of node ni as follows:

$$U(n_i) = N(n_i) - [N(n_i) \cap N(s)] - \{s\},$$

$$T_p(n_i) = 1 - \frac{|N(s) \cap N(n_i)|}{|N(s)|}$$

$$T_d(n_i) = MaxDelay \times T_p(n_i),$$

The delay time is used to determine the node transmission order. To sufficiently exploit the neighbor coverage knowledge, it should be disseminated as quickly as possible. When node s sends an RREQ packet, all its neighbors ni; i = 1; 2; . . . ; |N(s)| receive and process the RREQ packet. We assume that node ni has the largest number of common neighbors with node s, node nk has the lowest delay. Once node nk rebroadcasts the RREQ packet, there are more nodes to receive it, because a node ni has the largest delay. Based on the rebroadcast delay, a node set the timer. When a node receives the duplicate RREQ packet before expires the timer, it adjusts the UCN list.

MODULE 3

Additional coverage ratio

$$R_a(n_i) = \frac{|U(n_i)|}{|N(n_i)|}.$$

This metric indicates the ratio of the number of nodes that are additionally covered by this rebroadcast to the total number of neighbors of node ni. The nodes that are additionally covered need to receive and process the RREQ packet. As Ra becomes bigger, more nodes will be covered by this rebroadcast, and more nodes need to receive and process the RREQ packet, and, thus, the rebroadcast probability should be set to be higher.

Connectivity factor:

$$F_c(n_i) = \frac{N_c}{|N(n_i)|},$$

Where Nc = 5:1774 log n, and n is the number of nodes in the network, It observes that when |N(ni)| is greater than Nc, Fc(ni) is less than 1. That means node ni is in the dense area of the network, then only part of neighbors of node ni forwarded the RREQ packet could keep the network connectivity. And when |N(ni)| is less than Nc, Fc(ni) is greater than 1. That means node ni is in the sparse area of the network, then node ni should forward the RREQ packet in order to approach network connectivity. Combining the additional coverage ratio and connectivity factor, we obtain the rebroadcast probability Pre(ni) of node ni:

$$P_{re}(n_i) = F_c(n_i) \cdot R_a(n_i),$$

The parameter Fc is inversely proportional to the local node density. That means if the local node density is low, the parameter Fc increases the rebroadcast probability, and then increases the reliability of the NCPR in the sparse area. If the local node density is high, the parameter Fc could further decrease the rebroadcast probability, and then further increases the efficiency of NCPR in the dense area. Thus, the parameter Fc adds density adaptation to the rebroadcast probability.

MODULE 4

In NCPR protocol the RREQ flooding is based on the rebroadcast delay and rebroadcast probability. The rebroadcast probability is less than the threshold value, the node will not broadcast the RREQ packets, because the node is identified the dense area. Suppose due to the mobility of nodes are moving into another location, in that situation the packets are not reached in the destination. Therefore to solve this issue, this project contributes a nodes having highest energy will broadcast the RREQ packets to its neighbors. This condition is only applied in the dense area. Therefore the rebroadcast probability of node is less than the threshold value; the nodes having highest energy will broadcast the RREQ packets to its neighbors.

MODULE 5

Performance Metrics

MAC collision rate:

The average number of packets (including RREQ, route reply (RREP), RERR, and CBR data packets) dropped resulting from the collisions at the MAC layer per second.

Normalized routing overhead:
The ratio of the total packet size of control packets (include RREQ, RREP, RERR, and Hello) to the total packet size of data packets delivered to the destinations.

Packet delivery ratio:
It defined as the ratio of the number of data packets successfully received by the CBR destinations to the number of data packets generated by the CBR sources.

Average end-to-end delay:
The average delay is defined as the successfully delivered CBR packets from source to destination node. It includes all possible delays from the CBR sources to destinations.

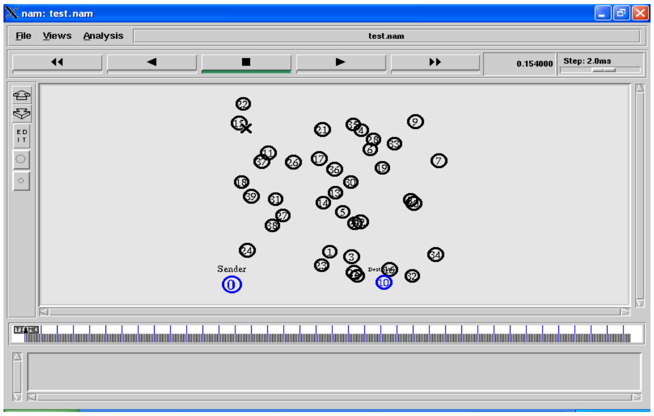
IV. SIMULATION SETUP & RESULT DISCUSSION

Extensive simulations were conducted using NS-2.35. The simulated network consisted of the 120 mobile nodes that were randomly scattered in a 2000x2000m area at the beginning of the simulation. The tool was used to produce mobility scenarios, where nodes are moving at six different uniform speeds ranging between 0 to 10 m/s and a uniform pause time of 10s.

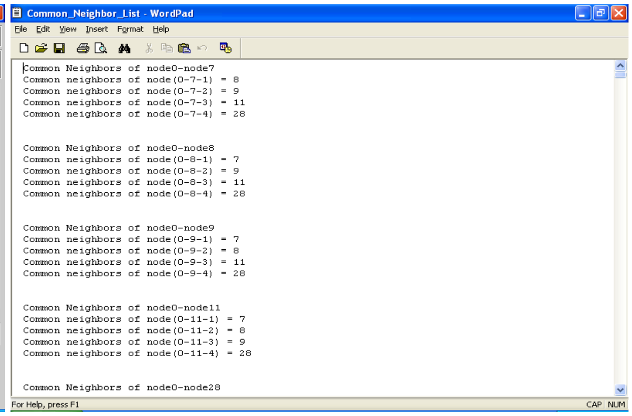
Software for simulation	NS-2.35
Channel	Wireless
Simulation Time	50 Sec
Area	2000*2000
Packet size	1024 Bytes
Speed	1 m/s to 10m/s
Routing Protocol	E-EPAR
Propagation Model	Two Ray Ground
Network Interface Type	Wireless Physical
Queue Type	DropTail
Mac Type	Mac/802.11
Antenna Type	Omni Directional
IFQ- Length	50 Packets

Screenshots

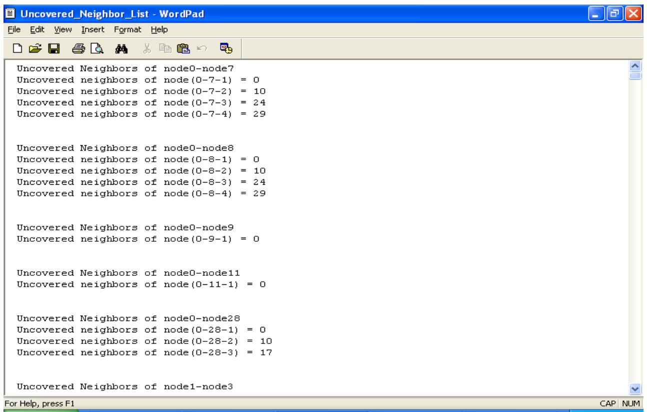
DOI: 10.18535/ijecs/v5i5.25

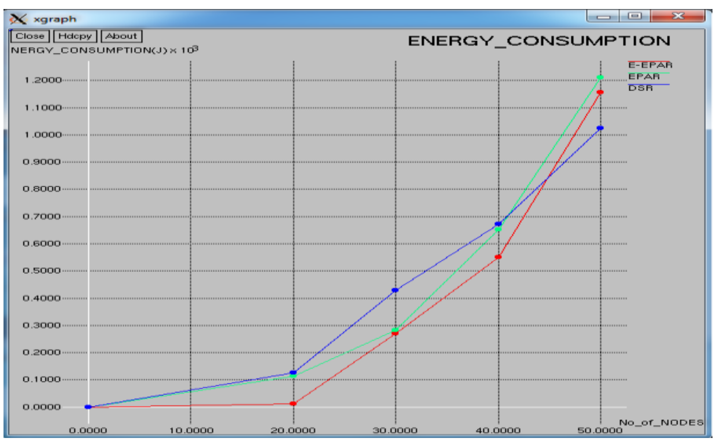


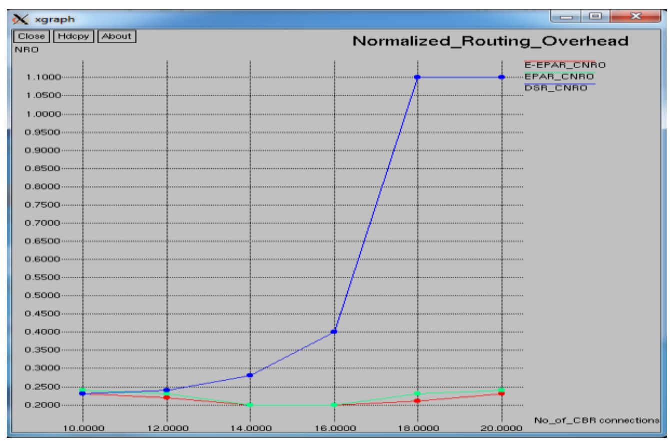
Simulation



Common neighbor



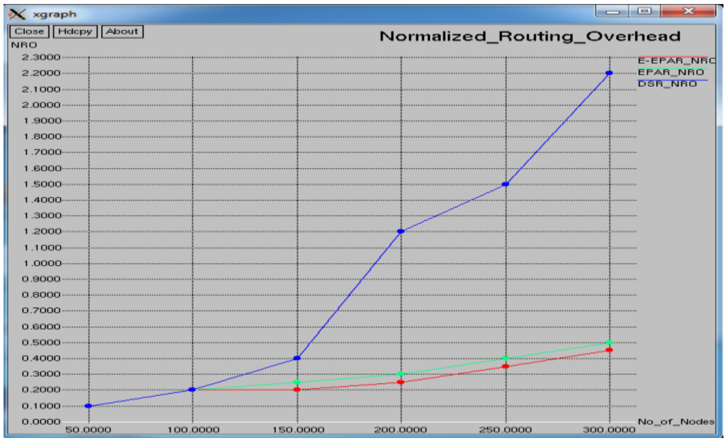




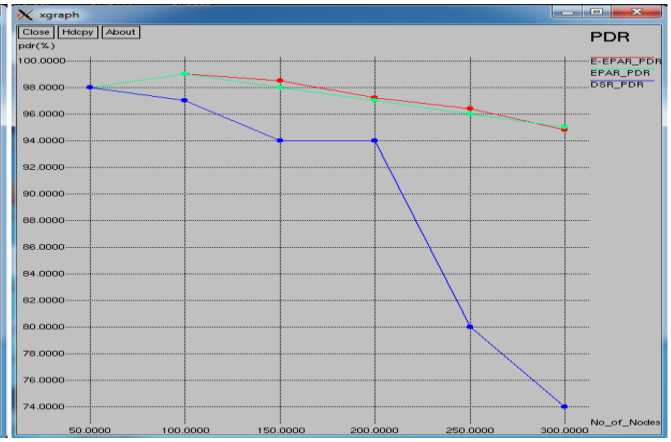
Energy consumption vs. No. of Nodes

Normalized Routing Overhead vs. No. of CBR Connection

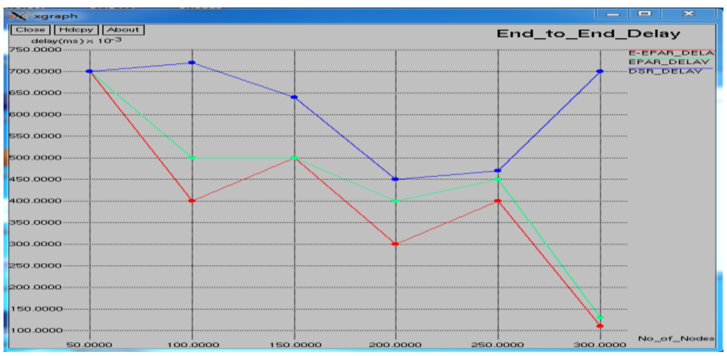
DOI: 10.18535/ijecs/v5i5.25



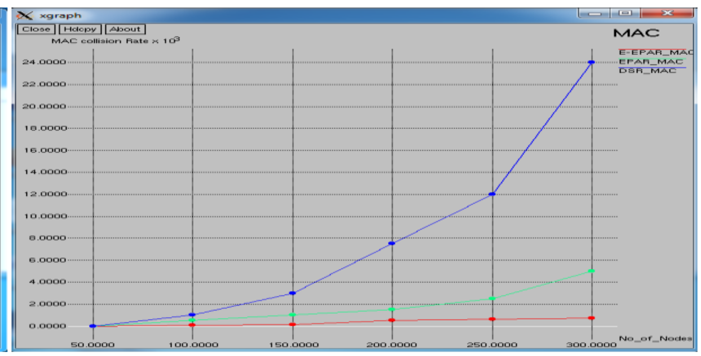
Normalized Routing Overhead Vs. No. of Nodes



Packet Delivery Ratio Vs No. of Nodes



End to End Delay Vs. No. of Nodes



MAC Vs. No. of Nodes

CONCLUSION

Broadcasting is an active research topic in MANETs. An important problem is how to minimize the number of rebroadcast packets while power consumption, good retransmission latency and packets reach ability are maintained. Even though the large number of rebroadcasts guarantees high reach ability, it causes high network bandwidth wastage, Power consumption and so many packets collisions. On the other hand, the small number of rebroadcasts results in low reach ability, because it cause rebroadcast chain broken so that some hosts may not receive the broadcast packets. In this Paper, we proposed a optimized protocol based on destination towards neighbor coverage to reduce the routing overhead and power consumption in MANETs. This neighbor coverage knowledge includes additional coverage ratio and connectivity factor. The rebroadcast delay determines the forwarding order and the node which has more common neighbors with the previous node has the lower delay. If this node rebroadcasts a packet, then more common neighbors will know this fact. It enables the information that the Simulation results show that our approach can improve the average performance of broadcasting in various network scenarios with optimized power. Our approach is simple and can be easily implemented in MANET.

REFERENCES

[1] Shivashankar, G.Varaprasad et. al. "Designing energy Routing Protocol with Power consumption Optimization in MANET," *IEEE Transaction on Emerging Topics in Computing vol. 2, no. 2 , pp.192-197, 2013*.

[2] V. Rishiwal, S. Verma et. al. "QoS based power aware routing in MANETs*", Int. J. Comput. Theory Eng., vol. 1, no. 1, pp. 47-54, 2009.*

[3] N. Bisht, R. Mishra et.al. "Mobility Based Performance Analysis of Wireless Sensor Networks," *International Journal of Computer, Electronics & Electrical Engineering, vol. 2, no. 2, pp 15-20, 2014.*

[4] Royer and E.M., "A Review of Current Routing Protocols for Ad Hoc Mobile Wireless Networks," *In IEEE Personal Communications, vol. 6, no. 2, pp 46-55, 2002.*

[5] C. Sarr and C. Chaudet, "Improving Accuracy in Available Bandwidth Estimation for 802.11-based Ad Hoc Networks," *In INRIA,RFC No.5935, vol. 2, no. 2, pp. 1-20, 2006.*

[6] D. Kim, J. J. Garcia-Luna-Aceves, et. al. ,"Routing mechanisms for mobile ad hoc networks based on the energy drain rate," *IEEE Trans. Mobile Comput., vol. 2, no.2 ,pp.161-173, 2006.*

[7] Hussein Al-Bahadili, "Enhancing the Performance of Adjusted Probabilistic Broadcast in MANETs", *The Mediterranean Journal of Computers and Networks, vol. 6, no. 4, pp. 1-7, 2010*.

[8] C. Poongodi and A. M. Natarajan, "Optimized replication strategy for intermittently connected mobile networks," *Int. J. Business Data Communication Network, vol. 8, no. 1, pp. 1-3, 2012.*

[9] S. Mishra, I. Woungang, and S. C. Misra, "Energy efficiency in ad hoc networks," *Int. J. Ad Hoc, Sensor Ubiquitous Comput., vol. 2, no. 1, pp.139-145, 2011*.

[10] F. Xue and P.R. Kumar, "The Number of Neighbors Needed for Connectivity of Wireless Networks," *Wireless Networks, vol. 10, no. 2, pp. 169-181, 2004.*

[11] S. Shankar, B. Sivakumar, G. Varaprasad, and G. Jayanthi,"Study of routing protocols for minimizing energy consumption using minimum hop strategy in MANETs," *Int. J. Comput. Commun. Netw. Res., vol. 1. no. 3, pp.10-21, 2012.*

[12] V. Rishiwal, S. Verma, and S. K. Bajpai, "QoS based power aware routing in MANETs*," Int. J. Comput. Theory Eng., vol. 1, no.1, pp. 47-54, 2009.*

[13] S. Gupta, C. K. Nagpal, M. Kaur, and B. Bhushan,"Impact of variable transmission range on MANET performance," *Int. J. Ad Hoc, Sensor Ubiquitous Comput., vol. 2, no. 4, pp. 59-66, 2011*.

[14] Perkins et. al., "A survey on quality-of-service support for mobile ad hoc networks," *Wireless Communications and Mobile Computing, vol. 2, no. 5, pp. 503-513, 2002.*

[15] C. Perkins, E. Royer, and S. Das ," Performance Comparison of Two on Demand Routing Protocols for Ad hoc Networks*," IEEE Personal Communications, vol.1, no. 10, pp. 16- 28, 2001.*

[16] S. Muthuramalingam et. al. , "Algorithm for MANETs by modifying weighted clustering algorithm with mobility prediction," *Int. J. Comput. Elect. Eng., vol. 2, no. 4, pp. 709-714, 2010.*

[17] W.-H. Lio, Y.-C. Tseng, and K.-P. Shih, "A TDMA based bandwidth reservation protocol for QoS routing in a wireless mobile adhoc network," *in Proc. IEEE Int. Conf. Commun., vol. 5, pp. 3186-3190, 2002.*

[18] S.-L. Wu, Y.-C. Tseng, and J.-P. Sheu, "Intelligent medium access for mobile ad hoc networks with busy tones and power control*," IEEE J. Sel. Areas Commun., vol. 18, no. 9, pp. 1647-1657, 2000.*