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Max-Energy Node Selection and Average Energy Path Selection based Routing in MANET

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Abstract*—Energy aware routing in mobile ad hoc networks (MANET) is the major problem to finding energy efficient routes that maximize the network lifetime without the knowledge energy status of nodes in network. To improve network performance, the paths for message flows are chosen in such a way that the total energy consumed along the path be minimized while avoiding energy-depleted nodes. Finding paths that consume minimum energy and finding paths that do not use energy-depleted nodes lead to conflicting objectives. In this paper, we propose an energy aware routing technique that selects the MAX energy holding nodes and calculate the average of nodes energy and if the path has maximum energy then in that case, the maximum average energy path is selected for sending data in network. This proposed method always utilizes the maximum energy nodes and for reliable connection it is essential in network. A simulation-based performance comparison between a normal energy based routing ad hoc protocol and its modified proposed energy based protocol are done by ns-2 simulator and the simulation results are showing the better results of network performance and energy utilization.

***Key words*—MANET, Energy aware routing, MAX Energy, Average energy, Reliable routing,**

I. INTRODUCTION

In mobile ad hoc network (MANET) each node creates a network link in a self-organizing manner, forwarding data packets for other nodes in the network [1]. Mobile ad hoc networks (MANETs) are instantly deployable without any wired base station or fixed infrastructure [2]. Due to these features, MANETs suffers from limitations like lower capacity, limited security, higher loss rates, more delays and jitter as compared to fixed networks. A critical issue for MANETs is that the activity of node is energy-constrained [3]. In MANET, operations of nodes rely on batteries or other exhaustible power supplies for their energy. Hence depletion of batteries will have greater effect on overall network. As a consequence, energy saving is an important system design criterion. Mobile Ad hoc wireless networks are energy constrained since nodes operate with limited battery energy. If some nodes die early due to lack of energy, they cannot communicate with each other. Therefore, inordinate consumption of nodes energy should be prevented. In fact, node energy con-sumption should be balanced in order to increase the energy awareness of networks and find out the scheme has been proposed that utilizes energy status of each mobile node and alternate paths. This scheme can be incorporated into any ad hoc on-demand routing protocol to improve reliable packet delivery in the face of node movements and route breaks.

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Alternate routes are utilized only when data packets cannot be delivered through the primary route. As a case study, it has been ap-plied to AODV and performance has been studied via simulations [1].

Routing protocols [4] have to suggest best possible path from source to destination for efficient data transfer. For any application, the mobility of nodes as well as limited battery resources must be considered as design issues for expecting best performance from the network under consideration. It is very difficult to have correct data delivery under mobility conditions and to save the node power at the same time. Routing protocols are classified as Proactive, Reactive and Hybrid based on the method of maintaining route information in the protocol. In proactive protocols all routes are maintained regardless of the state of use.

The rest of this paper is organized as follows In section 2 has presents the related work and Section 3 has problem statement and in section 4 we discuss proposed scheme after that in section 5 we analyze the network behavior under network simulator-2. Finally in section 6 present the conclusion with future work.

II. RELATED WORK

This section represents the related work that has been done in this field. This previous work is aware about the effort that has researchers do in this field.

This research [5] proposes a novel method based on energy estimation to restore broken links and reconstruct the paths of them. So investigate Effect of broken links on topology control and routing process in Ad Hoc network. It was indicated that these effects were harmful in the mentioned couple of network portions. This work has been used Hardware Method for estimation energy in ad hoc node, so this method has a high speed and finally find out the or Investigating the effect of link break on ad hoc network, one may find out that both routing algorithms and also topology control will be negatively affected and, in some cases, the entire network is disorder. These effects may cause to some serious problems in data transferring and efficiency of different parts of network. For this purpose a strategy was made in order to prevent link break and disordering. This strategy could give some suggestions to route the network through prediction and time estimation of link break.

In this [6] research many new routing and MAC layer protocols and different techniques have been proposed for WSN network and most of them trying to resolve the resource constrained for unattended wireless sensor environment, The majority of all the protocols mainly Concentrate on energy efficiency of sensor nodes, however sensor application have very important role specially in critical applications like the defense and health where the accuracy and guaranteed data transfer timely is an important issue.

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In this research [7] discuss how we improved the MChannel group communication middleware for Mobile Ad-hoc Networks (MANETs) in order to let it become both delay- and energy-aware. MChannel makes use of the Optimized Link State Routing (OLSR) protocol, which is natively based on a simple hop-count metric for the route selection process. Based on such metric, OLSR exploits Dijkstra's algorithm to find optimal paths across the network and added a new module to MChannel, enabling unicast routing based on two alternative metrics, namely end-to-end delay and overall network lifetime. With such new module, we prove that network lifetime and average end-to-end delay improves, compared to the original OLSR protocol implementation included in the mentioned middleware and finally have evaluated and proposed two extensions of the OLSR protocol aimed at considering the mentioned metrics.

This research [8] proposed a new reliable protocol called Enhanced Power Control MAC Protocol for Wireless Ad Hoc Networks (EPCMAC) the key concept of this EPCMAC protocol is to improve the throughput and to save energy by sending all the packets with optimal transmit power. This communication approach promises improved throughput and delay performance by effective use of spatial diversity in wireless ad hoc networks. Also, the power of the data packets is periodically raised to a suitable level but not to the maximum so that it will avoid interference and unnecessary contention between nodes.

This research [9] introduces an Energy Efficient Location Aided Routing (EELAR) Protocol for MANETs that is based on the Location Aided Routing (LAR). EELAR makes significant reduction in the energy consumption of the mobile nodes batteries by limiting the area of discovering a new route to a smaller zone. Thus control packets overhead are significantly reduced. To show the efficiency of the proposed protocol we present simulations using NS-2. Simulation results show that EELAR protocol makes an improvement in control packet overhead and delivery ratio compared to AODV, LAR, and DSR protocols and say about the conclusion an Energy Efficient Location Aided Routing Protocol (EELAR) that is an optimization to the Location Aided Routing (LAR). EELAR makes significant reduction in the energy consumption of the mobile nodes batteries through limiting the area of discovering a new route to a smaller zone. Thus a control packet overhead is significantly reduced and the mobile nodes life time is increased.

This research [10] introduce the addresses energy conservation, a fundamental issue of paramount importance in heterogeneous mobile ad hoc networks (MANETs) consisting of powerful nodes (i.e., P-nodes) as well as normal nodes (i.e., B-nodes). By utilizing the inherent device heterogeneity, we propose a cross-layer designed Device-Energy-Load Aware Relaying framework, named *DELAR*, to achieve energy conservation from multiple facets, including power-aware routing, transmission scheduling and power control and present a multi-packet transmission scheme to improve the end-to-end delay performance.

This research [11] introduce a new energy-aware routing policy based on dynamic priority factor named EDSR for ad hoc is proposed, which is based on the classic DSR (the routing protocol on demand). Simulation with the NS2 then compared with the on-demand routing DSR from the energy-consuming and the number of remaining nodes, the performance superior to the traditional DSR protocol. The EDSR routing which spends less energy and own larger link capacity, be synthetically analyzed and then selected, so it can save more energy, delay the network split. The EDSR routing which spends less energy and own larger link capacity, be synthetically analyzed and then selected, so it can save more energy, delay the network split**.**

In this research [12] have distinguished three families of energy efficient routing protocols. Few proposals especially focused on the design of routing protocols providing efficient power utilization are dealt in depth by [13]. The techniques are, Minimum Total Transmission Power Routing (MTPR), Minimum Battery Cost Routing (MBCR), Min-Max Battery Cost Routing (MMBCR), and Conditional Max- Min Battery Capacity Routing (CMMBCR). In addition to above techniques, minimum drain rate mechanism also needs to be considered for power saving. The drain rate is the rate at which energy gets dissipated at a given node. Each node monitors its energy consumption and maintains its battery power drain rate value during the given past interval.

In This paper [14] tried to make the OLSR energy efficient by making effective neighbor selection based on residual battery energy of a node and traffic conditions that influence the drain rate of the node in the network. We have considered the multipath and source routing concept for route selection and a route recovery technique to tackle mobility issue efficiently. Modifications make the protocol energy efficient and at the same time achieve balancing of network load.

III. PROBLEM STATEMENT

The problem of node failure is the major problem. The problem of node failure occur due to loss of energy, if node can loss their energy then it will do nothing in the network means it will be loss their communication capability their results in network partitioning, is serious in ad hoc networks. Network portioning or suddenly loss of session is the problems that will be occur due to we are not known at what time nodes will goes to sleep mode. Those nodes which are loss there energy they are not being a part of network, but nodes having a capability to take part in communication having a sufficient energy to do communication in the network. Due to suddenly loss of session following problems are occurring:

- Maximize the loss of packets.
- Maximize the routing load.
- Minimizes energy utilization

IV. PROPOSED WORK

Our proposed scheme is Energy Efficient depletion routing scheme deals with utilization of energy resources. There are little issues and solutions which witnesses the need of energy efficient routing in ad hoc wireless networks. In this work by using maximum energy concept try to remove the problem of "suddenly loss of session" and do the energy efficient routing. If any nodes in the network having a value smaller or equal to threshold value cannot take a part in communication and also calculate the average energy of all possible paths and select the path that has contain the maximum average energy level. By controlling the early depletion of the battery, adjust the energy to decide the proper energy level of a node and integrate the low power strategies into the protocols used in various layers of protocol stack. Proposed solution will definitely improves the :

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- Maximizes energy utilization.
- Reduces packet loss.
- Reduces routing load.

A. Algorithm for Maximum Energy Base routing Under MANET

Step 1: Create mobile node = N;
Step2: Set routing protocol = AODV; // **for Routing Protocol**
Step3: Set of N = { V_s, V_d, V_i, V_j, V_k, V_l, ... V_n} //Number of mobile node's
Step4: Set of Intermediate vertex or node's V_i, V_j, V_k, V_l, ... $V_{n \in N}$, but not
Step5: Set sender = V_s ; // **$V_s \in N$**
Step6: Set Destination = V_d; // **$V_d \in N$**
Step7: Initialize radio range = 550m;
Step8: Set MAC = 802.11 // WiFi Tecnology
Step9: Set initial energy of each node E = { e_s, e_d, e_i, e_j, e_k, e_l, ... e_n }
Step10: Compute Route (V_s, V_d, E, rr)
Step11:{if (radio-range <= rr && next-hop != V_d && E > 0)
{
Step12: If (path exist from V_s to V_i, && V_i **!=** V_d,)
Increment pointer V_i as V_j and V_s as V_i
Broadcast route packet to next hop
Step13: While (path exist from V_i to V_j && V_j != V_d)
{
Broadcast route packet to next hop
Increment pointer V_i and V_j
Goto step 13;

}
Step14: If (V_j == V_d)
{
Create rtable in V_d Node
Create energy table V_s-V_i-V_d
}
Step15: If (path > 1)
Step16:{ if (path V_{sijd} from S to D && path V_{skld} from S to D)
{
Create rtable V_s via path V_{ij} to V_d
Create energy table e_s via path e_{ij} to e_d
Create rtable V_s via path V_{kl} to V_d
Create energy table e_s via path e_{kl} to e_d
}
}
Step17: Find min-energy (e_i, e_j) if e_j energy minimum
Step18: Find min-energy (e_k, e_l) if e_k energy minimum
Step19: Find Max-eng (e_j, e_k)
Step20: { if (ej max-eng)

Select route V_s via path V_{ij} to V_d
}
}
Step21: End
}

On the basis of proposed algorithm any node in the network are always select the nodes that has a maximum energy value. It means that it solves the problem of link breakages in network. The problem in normal energy efficient routing is that nodes in the network are not aware about the energy values of nodes. If the sender has selected the low energy value node which has not trustful for communication then in that case the session between the nodes are suddenly expire by that the huge amount of energy is wasted. But in this proposed algorithm these chances are negligible it means that sender are not do the normal routing in network it apply the maximum (MAX) energy selection method and ignores minimum (MIN) value of nodes in network. And if the path in between the sender and destination is established then also compare the energy value of alternative path and select the best one on the basis of MAX energy value.

V. SIMULATION ENVIRONMENT

A Simulation, is the process of designing a model of a real system and conducting experiments with this model for the purpose either of understanding the behavior of the system or of evaluating various strategies (within the limits imposed by a criterion or set of criteria) for the operation of the system" [15]. Therefore Modeling & Simulation was the main part of this research in which application of different simulations techniques was developed using the NS-2 (Network Simulator) simulator. The entire simulation tests were conducted by using a very well known simulator by the research community NS2, by applying topologies and approaches.

A. Simulation Parameters Used

Table 1 are represents the following simulation parameters to make the scenario of routing protocols. On the basis of these parameters the simulation has done in this work.

Table 1 Simulation Parameters

Simulator Used	NS-2.31
Number of nodes	10,30
Dimension of simulated area	800m×600m
Routing Protocol	AODV
Simulation time	100 sec.
Traffic type (TCP & UDP)	CBR (3pkts/s)
Packet size	512 bytes
Number of traffic connections	5,30
Node movement at maximum Speed	random (20 m/s)
Transmission range	250m
Transmission Energy Consumption	1.5 joules
Receiving Energy Consumption	1 joules
Idle Energy Consumption	.17joules
Sleep Energy Consumption	.047

B. Performance Evaluation

There are following different performance metrics [4] have been considered to make the comparative study of these routing protocols through simulation.

1) ***Routing overhead:*** This metric describes how many routing packets for route discovery and route maintenance need to be sent so as to propagate the data packets. The lower value of routing load are represents the better network performance.

2) ***Packet Delivery Ratio:*** The ratio between the amount of incoming data packets and actually received data packets. The higher value of PDR is represents the better performance.

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3) ***Average Delay:*** This metric represents average end-to-end delay and indicates how long it took for a packet to travel from the source to the application layer of the destination. It is measured in seconds.

4) ***Remaining Energy Analysis:*** This metric represents the energy utilization of each node in network. The more remaining energy represents the higher energy efficient utilization.

C. PDR Analysis in case of without Average Energy and Average Energy Scheme

The Packet Delivery Fraction (PDF) analysis is represents the successful percentage of data received at destination. This graph is represents the packet percentage in case of proposed average energy path section MAX energy based routing and previous normal energy shortest path selection routing. Here this graph represents the slightly more PDF in normal energy based routing or without average energy based routing but the routing load in that case are more shown in figure 2. If the routing load in network are more it means energy consumption are more by that the life of nodes are lost early as compare to proposed. It means PDF value is good not show that the overall performance of network are also better. The better PDF represents the better performance.

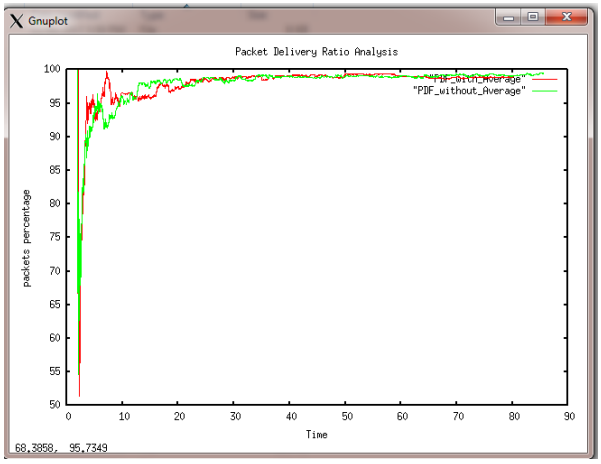

Fig. 1Packet Delivery Ratio Analysis

D. Routing Packets Analysis in case of without Average Energy and Average Energy Scheme

Routing packets in network are required to established connection in between source and destination. First routing packets are established connection with destination if destination replies to sender by connection confirmation packet. The routing packets in network are consumes energy it means minimum number of routing packets are deliver maximum amount of data packets in efficient routing. In this graph in case of previous without energy based or normal shortest path routing with energy factor the routing load are more it means the problem of connection failure are occur more here by that the more routing packets are required then energy also required for routing packets transmission and in proposed work the route has selected on the bases of maximum energy and path selection is based on average energy of path in between sender and receiver by that energy consumption are reduces and minimizes the routing overhead.

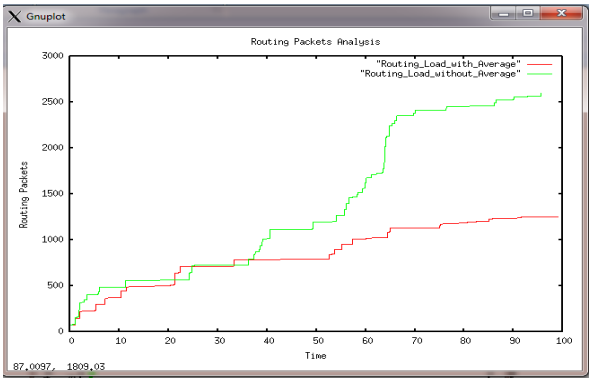

Fig.2 Routing load analysis

E. Energy Depletion in case of Average Energy Scheme

This graph represents the energy depletion of nodes in case of proposed scheme. In this graph we clearly notice the smooth depletion of energy from initial energy to energy remain in nodes after the end of simulation time. It means the proposed scheme based routing selection strategy are maintained the reliability in network.

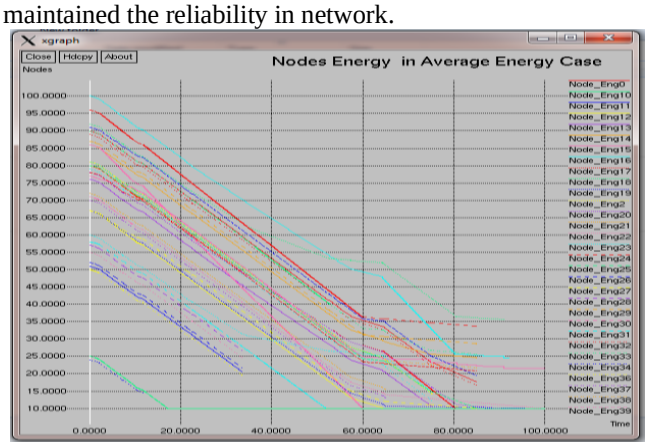

Fig. 3 Nodes energy depletion in Average energy based routing

F. Energy Depletion in case of without Average Energy

This graph represents the energy depletion of mobile nodes in case of without average energy based scheme. Here we clearly visualized that the lot of variations in energy graph it proves that the normal shortest path selection routing with energy factor are not sure to provide reliable connection in network.

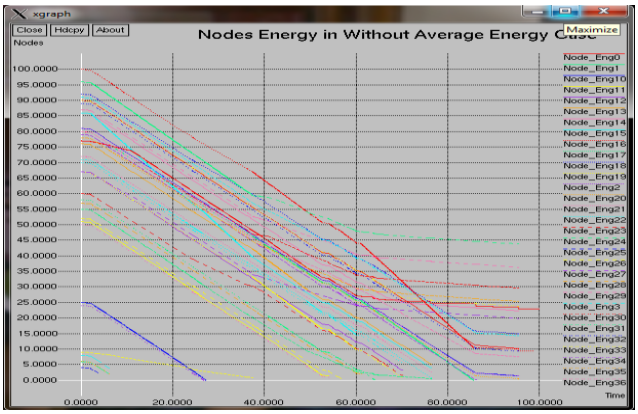

Fig. 2 Nodes energy depletion in without Average energy based routing

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G. Nodes Remaining Energy Analysis in case of Previous and Proposed scheme

The remaining energy analysis of each node is discussed in table 2. Here the three column are represents the node number, remaining energy in without average case and remaining energy in case of average energy based path selection scheme. Here the remaining energy of nodes are represents the life time of network. In case of proposed scheme all nodes are secure their energy more as compare to normal energy scheme or previous scheme except node number 24, 29, 30. The entry of node energy 1,3,4,5 and 35 are written not consider means these energy in network are not utilizes for communication.

Table 2 Remaining Energy Analysis

Nodes	Node Energy Without Average	Node Energy With Average
0	10.216399	17.74694
1	1.90485	Not Consider
2	1.315566	14.18527
3	3.872496	Not consider
4	2.297087	Not consider
5	0.765903	Not consider
6	0.15649	12.19163
7	25.310699	20.8907
8	7.583608	10.16041
9	14.260953	19.48528
10	1.320336	14.2825
11	1.293378	20.67857
12	3.243234	10.09908
13	4.986916	10.52112
14	22.258056	24.60506
15	3.931185	9.999915
16	9.430502	24.57971
17	0.002004	9.995028
18	14.899458	35.50516
19	0.94109	9.993236
20	0.439222	10.00147
21	2.539103	15.43135
22	0.750769	9.994654
23	1.586133	14.91732
24	43.760524	33.70311
25	0.010526	9.996716
26	0.589155	21.70543
27	19.851297	10.01578
28	1.967195	26.671
29	36.247239	28.66886
30	22.871192	21.61472
31	0.075592	10.07274
32	9.315185	16.75454
33	23.721248	25.6697
34	0.002075	14.51893
35	1.861165	Not consider
36	0.876278	19.58919
37	5.650517	13.03849
38	29.617427	21.72932
39	0.427492	24.6721

VI. CONCLUSION AND FUTURE WORK

This table represents the overall analysis in case of previous and proposed scheme. Here we clearly notice that in case of proposed average energy based scheme large number of packets are sending in network as compare to normal routing. The value of PDF are slightly low that also discuss before but routing load and delay are definitely minimized which is the major unnecessary consumption of energy.

Table 1 Overall analysis

Parameters	Previous	Proposed
SEND =	5074.00	5532.00
E RECV =	5036.00	5472.00
ROUTINGPKTS =	2596.00	1254.00
PDF =	99.25	98.92
NRL =	0.52	0.23
Average e-e delay(ms)=	469.04	272.81

In future we apply this energy based scheme with location coordinated based routing and compare their performance with this research.

REFERENCES

1. Taesoo Jun, Angela Dalton, Shree shankar Bodas, Christine Julien, and Sriram Vishwanath, “Expressive Analytical Model for Routing Protocols in Mobile Ad Hoc Networks”, IEEE international Conference on Communication, pp. 1-7, 2008.
2. X.Hong, K.Xu and Gerla, “Scalable Routing Protocols for MANET”, *IEEE network*, Vol. 16, pp. 11-21, 2002.
3. P. Sivasankar, C.Chellappan and S. Balaji, “Performance Evaluation of Energy Efficient On demand Routing Algorithms for MANET”, 2008 IEEE Region 10 Colloquium and the Third ICIIS, Kharagpur, INDIA, pp. 1-5, 2010.
4. Ajit Singh, Harshit Tiwari, Alok Vajpayee and Shiva Prakash, “ A Survey of Energy Efficient Routing Protocols for Mobile Ad-hoc Networks”, International Journal on Computer Science and Engineering (IJCSE), Vol. 02, No. 09, pp. 3111-3119,2010.
5. Peyman Arebi “A New Method for Restoration Broken Links in Wireless Ad-hoc Networks by Estimation Energy Consumption”, IEEE Fourth International Conference on Computational Intelligence, Communication Systems and Networks, 2012.
6. Mansoor-uz-Zafar Dawood,Noor Zaman,Abdul Raouf Khan,Mohammad Salih “Designing of energy efficient routing protocol for Wireless Sensor Network (WSN) Using Location Aware (LA) Algorithm.” Journal of Information & Communication Technology Vol. 3, No. 2, pp 56-70, 2009.
7. Nicola Costagliola · Pedro Garcia López · Francesco Oliviero · Simon Pietro Romano **“**Energy- and Delay-Efficient Routing in Mobile Ad Hoc Networks”, Springer Science Business Media, LLC, 23 July 2011.
8. Sofy Harold And A. Vija Y Alakshmi “Enhanced Power Control MAC Protocol for Wireless Ad Hoc Networks”, ICCSP, 978-1-4673-1622-4/12/, IEEE-2012.
9. Mohammad A. Mikki **“**Energy Efficient Location Aided Routing Protocol for Wireless MANETs”,(IJCSIS) International Journal of Computer Science and Information Security Vol. 4, No. 1 & 2, 2009.
10. Wei Liu, Chi Zhang, Guoliang Yao and Yuguang Fang,” DELAR: A Device-Energy-Load Aware Relaying Framework for Heterogeneous Mobile Ad Hoc Networks”, IEEE-Journal On Selected Areas In Communications, Vol. 29, No. 8, September 2011.
11. Nini Wei,Yi Song “An Energy-Aware Routing Strategy Based on Dynamic Priority Factor in Ad Hoc Networks”,2011 International Conference of Information Technology, Computer Engineering and Management Sciences, pp.6-11 IEEE, 2011.
12. Ajina A, “Energy Efficient, Power Aware Routing Algorithm for Sensor Network”. International Journal of Computer Theory and Engineering, Vol.3, No.1.1793-8201, February-2011.
13. Saoucene Mahfoudh and Pascale Minet,“ An energy efficient routing based on OLSR in wireless ad hoc and sensor networks”, 22nd International Conference on Advanced Information Networking and Applications Workshops IEEE Computer Society, pp. 1253-1259, 2010.
14. Radhika D. Joshi and Priti P.Rege “Verification Of Energy Efficient Optimized Link State Routing Protocol Using Petri Net “International Journal of Wireless & Mobile Networks (IJWMN) Vol. 3, No. 4, August 2011.
15. K Fall and K. Varadhan, The NS Manual, November 18, 2010, available on http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf. 25 July 2010.

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