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Energy Level Accuracy and Life Time Increased in Mobile Ad-Hoc Networks Using OLSR

Yogendra Kumar Jain
Head of CSE Department,
S.A.T.I,. Vidisha, M.P.

Rakesh Kumar Verma
M. Tech. (CSE),
S.A.T.I., Vidisha, M.P.

***Abstract*—Mobile ad-hoc network is collection of movable node without any need of infrastructure and each node contain routing table with contain each node energy value in joule. Our basic approach to efficient utilize node energy according energy parameter like transmission power, receiving power, ideal power and sleep power etc. Energy is the scarcest resource for the operation of the mobile ad hoc networks. Idle energy consumption is responsible for a large portion of the overall energy consumption in the wireless interfaces of the mobile nodes. Therefore, it is crucial to energy conservation efforts that this source of energy is eliminated or reduced. Our goal in this research is to create a new energy accuracy scheme that works on reducing waste full energy consumption and increases data transmission and life time of the network. In this paper we use routing protocol as optimal link state routing (OLSR). And analyze the network behaviour on the bases of energy discharge, TCP packet analysis, UDP packet analysis, end-to-end delay bases and packet delivery ratio etc. It aims at achieving energy conservation in a manner fair to all network nodes. It is distributed in nature, and its functionality is independent of the strategy and architecture of the routing protocol**

***Keywords*— Routing Load, average end-to-end delay, packet delivery fraction, TCP, UDP, and OLSR.**

I. INTRODUCTION

Ad hoc routing protocols are usually classified as being table-driven or on-demand depending on their response to changes in the topology of a network. Table-driven routing protocols (also called proactive protocols) maintain a continuous view of the full topology of the network in each node, whereas on-demand protocols (also called reactive protocols) search for a route between a source and a destination when such a route is needed. Table-driven approaches introduce more overhead compared to reactive ones. This is because whenever there are changes in the topology of the network, control messages are flooded in order to maintain a full knowledge of the network in each node. Initially, the main criterion in these two classes of protocols was the minimum number of hops. However, the main shortcoming of this criterion in terms of energy utilization is that the selection of routes in accordance with the min-hop principle does not protect nodes from being overused. These are usually nodes in the core of the network. When they run out of power, the network becomes partitioned and consequently some sessions are disconnected [2].

In order to alleviate this problem and to achieve energy-efficient consumption, many solutions have been proposed as an extension of the already existing ad hoc routing protocols.

Since table-driven protocols are inherently more energy-consuming compared to on-demand ones, most of the proposals involve modifications to reactive protocols. The energy-aware algorithms referenced here are implemented in the most common OLSR routing protocol, Optimized Link State Routing (OLSR) is a routing protocol used for Mobile Ad-Hoc Networks (MANET) [1]. It is a best-effort proactive protocol. Proactive protocols are characterized by all nodes maintaining routes to all destinations at all times through the periodic exchange of protocol messages. This gives them the advantage of having pre-computed routes available when needed and to propagate topology changes in bulk updates to many nodes. OLSR performs hop-by-hop routing, where each node uses its most recent topology information for routing.

II. RELATED WORK

The main focus of research on routing protocols in MANETs has been network performance. There has been some study on power aware routing protocols for MANETs. Presented below is a brief review of some of them.

A. Power–aware Routing

S. Singh , M.Woo and C.S. Raghavendra [5] proposes a routing algorithm based on minimizing the amount of power (or energy per bit) required to get a packet from source to destination. More precisely, the problem is stated as:

$$\underset{\pi}{Min} \sum_{i \in \pi} T_{i,i+1}$$

where $T_{i,i+1}$ denotes the power expended for transmitting (and receiving) between two consecutive nodes, i and $i+1$ (a.k.a. link cost), in route π.

This link cost can be defined for two cases:

- When the transmit power is fixed
- When the transmit power is varied dynamically as a

function of the distance between the transmitter and intended receiver.
For the first case, energy for each operation (receive, transmit, broadcast, discard, etc.) on a packet is given by [3]:

$$E(packet) = b \times packet\_size + c$$

where *b* and *c* are the appropriate coefficients for each operation.
Coefficient *b* denotes the packet size-dependent energy consumption whereas *c* is a fixed cost that accounts for acquiring the channel and for MAC layer control negotiation.
The second case is more involved. Reference [4] proposes a local routing algorithm for this case. The authors assume that the power needed for transmission and reception is a linear function of d^{α} where *d* is distance between the two neighboring nodes and α is a parameter that depends on the physical environment. The authors make use of the GPS position information to transmit packets with the minimum required transmit energy. The key requirement of this technique is that the relative positions of nodes are known to all nodes in the MANET. However, this information may not be readily available. In addition, the GPS-based routing algorithm has two drawbacks. One is that GPS cannot provide nodes useful information about the physical environment (blockages, bit error rates, etc.) and the second is that the power dissipation overhead of the GPS device is an additional power draw on the battery source of the mobile node.

B. Battery-Cost Lifetime-Aware Routing Algorithms

1) Minimum battery cost routing: algorithm minimizes the total cost of the route. More precisely, this algorithm minimizes the summation of inverse of remaining battery capacity for all nodes on the routing path [6].

2) Min-Max battery cost routing: algorithm is a modification of the minimum battery cost routing. This algorithm attempts to avoid the route with nodes having the least battery capacity among all nodes in all possible routes. Thereby, it results in smooth use of the battery of each node [5][6].

3) Conditional Max-Min battery capacity routing: algorithm was proposed in [6]. This algorithm chooses the route with minimal total transmission power if all nodes in the route have remaining battery capacities higher than a threshold; otherwise, routes that consist of nodes with the lowest remaining battery capacities are avoided. Several experiments have been performed in [6] to compare different battery cost-aware routing in terms of the network lifetime. According to their reported results, the minimum battery cost routing exhibited superior results compared to the Min-Max *battery cost* routing in terms of the expiration times of the nodes in the network. Conditional Min-Max routing showed better or worse results depending on how the threshold value was chosen.

4) Maximum Residual Packet Capacity (MRPC): was proposed in [7]. MRPC is conceptually similar to the conditional Min-Max battery cost, but MRPC identifies the capacity of a node not just by the residual battery capacity, but also by the expected energy spent in reliably forwarding a packet over a specific link.

III. PROPOSED WORK

In our propose scheme we use the energy module with OLSR routing and set the initial energy to all node and also set transmission power, receiving power, idle power and sleep power required by the each node , according to various paper we set decreasing power of energy level and simulate the result of mobile nodes.
Ad hoc wireless networks are power 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, nodes energy consumption should be balanced in order to increase the energy awareness of networks. Here we proposed a new energy responsive routing scheme in MANET. In this scheme we set initial energy as 100 joule and apply maximum energy contained node with shortest path routing mechanism using OLSR protocol.
According to our proposed approach a new energy responsive routing scheme to make aware our network about the energy of nodes by that we remove the problem of suddenly loss of session to recognize the unfaithful nodes and extend the life cycle of network.
Energy Level Accuracy in Mobile Ad-Hoc Networks scheme deals with efficient utilization of energy resources. By controlling the early depletion of the battery, adjust the power to decide the proper power level of a node and incorporate the low power strategies into the protocols used in various layers of protocol stack. There are little issues and solutions which witnesses the need of energy aware routing in ad hoc wireless networks.

As we have shown earlier, idle energy consumption constitutes a significant percentage of the overall energy consumed by the wireless interfaces of network nodes. Therefore, reducing this energy should be a cornerstone in any energy conservation efforts. As will be seen, our proposed algorithm, Energy Level Accuracy in Mobile Ad-Hoc Networks, addresses the issue of idle energy consumption in a manner fair to all network nodes. Different nodes are given equal opportunities to conserve idle energy. When idle energy is addressed, another factor remains that may still affect energy fairness within the network and utilize that energy in transmission the packet.

A. Algorithm for Routing behaviour with energy level

//Create Routing module with energy level configure

Set NN = M; //Number of mobile node
Set RP = OLSR; //Routing protocol


```
Set rng = 250 m;  //rng for radio range
Set eng = 100 joule;          // initial energy
Set Tx = 1.5 j; Set Rx = 1.0 j; Set Sleep = 0.5 j; Set Sensing =
0.3 j; Set Ideal =0.1 j;
Set Sender = S;    // S ε M
Set receiver = R;  // R ε M
// Generate test Traffic
Compute route ();
RREQ_B (S, R, rng, eng)
{          // search route from source to destination
   if ((next_hop == true) && (rng ≤250) && (eng ≥ 10j))
{    next_hop -> Rx_RREQ;
     Call_energy();
     D_eng = eng--;//discharge energy
     rtable->insert(rtable->rt_nexthop); // nexthop to RREQ
source
    rtable1->insert(rtable1->rt_nexthop); // nexthop to RREQ
destination
if (destination == R)
  {
                 If (more route live)
                   {Check eng of both routes;
                        Call_energy();
                        If (rt1_eng > rt2-eng)
                       Accept RREQ_B;              //from rt1
                        D_eng = eng--;
            Send_ack through rtable1 to source node
                 }
         Else {   Accept RREQ_B;       //from rt2
                  D_eng = eng--;
                 Send_ack through rtable2 to source node
               }}
Else {destination not found ;}
} else {destination unreachable ;}
}
```

```
//Energy Level Accuracy and Check energy level of each node

Energy (eng, node)
{
If (energy_saving_ && node_->energy_model()!=NULL)
 {
  double cur_energy=node_->energy_model()->energy();
  if (cur_energy>10)
       {
              Send data packet through node;
      } else { energy_survival ; //Critical battery level
            }
                 }

if(energy_saving_ && energy_survival_ && node_-
>energy_model()!=NULL)
            {
              double initial_energy=node_->energy_model()-
>initialenergy();
         double cur_energy=node_->energy_model()->energy();
      if(energy_survival_threshold_<= 10)
        {
         energy_survival_threshold_ = 10.0;
        //regain energy = start_time*0.5  // till the full charge
                                          100j
        }
if(cur_energy<=energy_survival_threshold_*initial_energy)
       {
         sendLowEnergyNotification();
          energy_survival_=0;
       }
        }
   }
```

B. Simulation Environment

The simulator we have used to simulate the ad-hoc routing protocols in is the Network Simulator 2 (ns-2) [9] from Berkeley. To simulate the mobile wireless radio environment we have used a mobility extension to ns that is developed by the CMU Monarch project at Carnegie Mellon University.

Our simulation model has five major components: ad hoc mobile network formation, packet delivery event generator, mobile nodes migration engine, routing protocol engine and statistics analyzer, as illustrated in Figure 1.

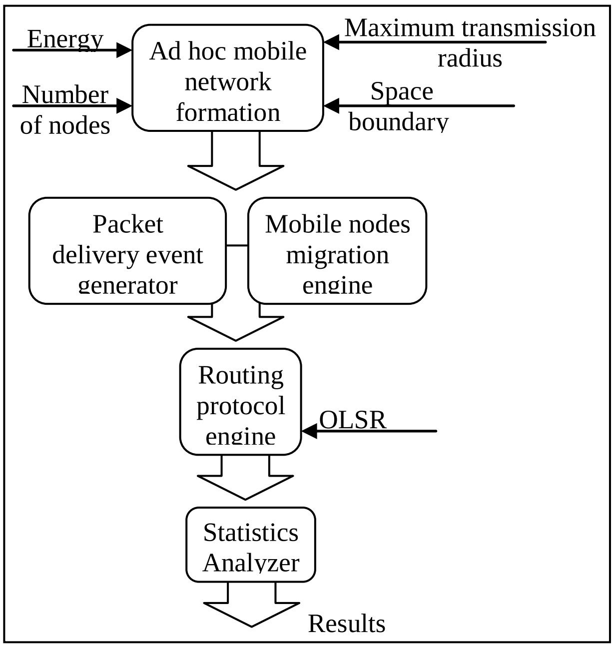

Fig. 1 An ad hoc mobile network simulation model.

The module of ad hoc mobile network formation takes in parameters of the space boundary, number of network nodes, their positions in space, energy of node and their maximum transmission radius. This module is implemented using Tcl script. The network formation is the simulation ground for packet delivery and mobile node migration events. The number of active communicating flows can be varied and the mobile nodes' migration speed and pause interval is node dependent. These are parameters inputted at simulation setup. Both events are generated using Tcl script and are subsequently handled by the routing protocol engine.

C. Evaluation Parameter

We get Evaluation Parameter like Number of nodes, Dimension, Routing protocol, transport layer protocol, application layer data and maximum speed of mobile nodes etc.
According to below table 1 we simulate our mobile ad-hoc network.

TABLE 1
EVALUATION PARAMETER

Number of nodes	100
Dimension of simulated area	1200x1200
Routing Protocol	OLSR
Simulation time (seconds)	100
Transport Layer	TCP ,UDP
Traffic type	CBR,FTP
Packet size (bytes)	800
Number of traffic connections	22
Speed (m/s)	Random

1) Energy model parameter for Simulation

In this table we show energy conservation parameter according to that parameter energy value discharge from the node.

TABLE 2
ENERGY UTILIZATION PARAMETER

TX power consumption	1.5W
Rx power consumption	1.0W
Idle power consumption	0.1W
Sleep power consumption	0.5 W

D. Performance Parameter

This section presents the performance parameters used to evaluate the proposed Energy Level Accuracy in Mobile Ad-Hoc Networks. The main performance parameters are Routing message overhead, average end to end delay, and throughput. Under each main performance parameters, there are secondary performance parameters which affect it or depend on it.

1) Routing Load: The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet or each hop counts as one transmission.

2) Average End to End Delay: This includes all the possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.
It is calculated as the total summation of the division of total end to end delay (Dt) by the number of packets delivered (Npd) divided by the number of nodes (Nn) as in Eq.(1)

$$\sum\left(\frac{Dt}{Npd}\right)/Nn$$

3) Packet Dropped : The routers might fail to deliver or drop some packets or data if they arrive when their buffer are already full. Some, none, or all the packets or data might be dropped, depending on the state of the network, and it is impossible to determine what will happen in advance.

E. Nam visualization

The simulation described in this project was tested using the ns-2 test-bed that allows users to create arbitrary network topologies [8]. By changing the logical topology of the network, ns-2 users can conduct tests in an ad hoc network without having to physically move the nodes. Ns-2 controls the test scenarios through a wired interface, while the ad hoc nodes communicate through a wireless interface.

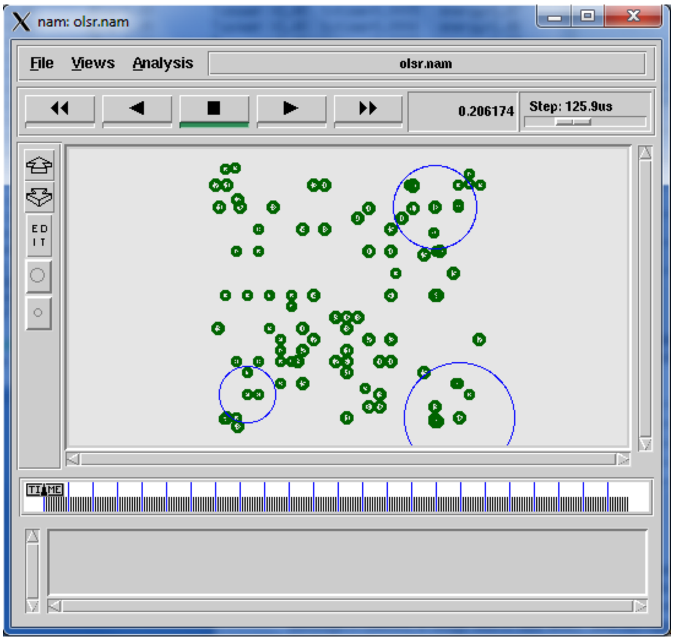

Fig. 2 A sample topology generated by ns-2 Hundred Node Case

The topology shown in Figure 2 is used 100 mobile nodes to show how the node senses the neighbour nodes and sends data to destination through shortest path. We first generate some test traffic in the network. TCP socket servers are initiated at nodes 6, 35, 39, 29 and 2 to generate TCP traffic. ten TCP socket clients are initiated at nodes 12, 41, 14,18,7 and 11. These clients send simple socket messages every 33 to 3 seconds to the servers. Node initiates a ping of node 10 and similarly node 20 initiates a ping of node 28 and 13 vice-versa in order to create UDP packet traffic within the network. Finally ten Secure Shell (SSH) sessions are initiated between node 6 and node 12, 35 and node 41, 39 and node 14, 29 and node 18, 2 and node 11, and node 33 and node 3. The trigger mechanism begins by separating the incoming and outgoing activity into two categories: broadcast and non-broadcast packets.

F. Gnuplot for TCP analysis in Energy aware scheme with OLSR routing

Here we present TCP flow graph at the time of energy aware technique applies with OLSR routing protocol, here we create ten TCP connections and analyze our result. Graph shows maximum TCP transfer through connection number seven and lower transmission through tenth connection. X-axis represent Time unit per/s and Y-axis represent No. of packets transfer by the connection.

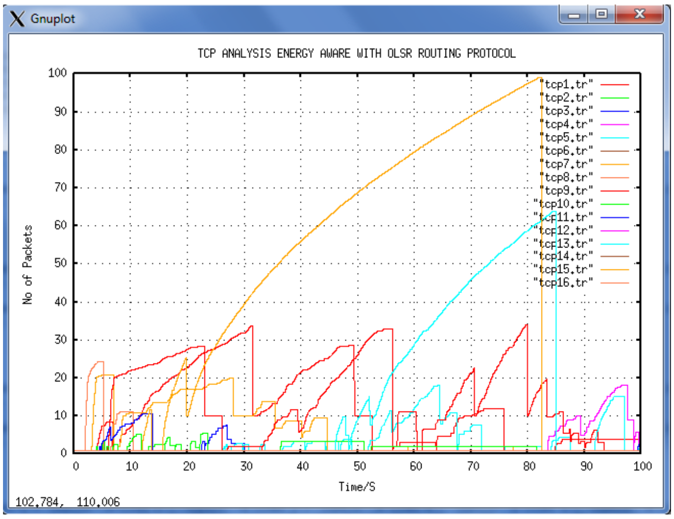

Fig. 3 Gnuplot for TCP Flow analysis through each link

G. Gnuplot for UDP analysis in fifty mobile node time

Here we show our result through gnuplot in this graph x axis show simulation time in sec. and y axis shows total udp packet according to our representation red line show total number of udp packets transmitted with respect to time, green line shows total number of UDP packets receives by the receiver and blue line shows UDP packet loss, according to graph our loss percentage is minimum.

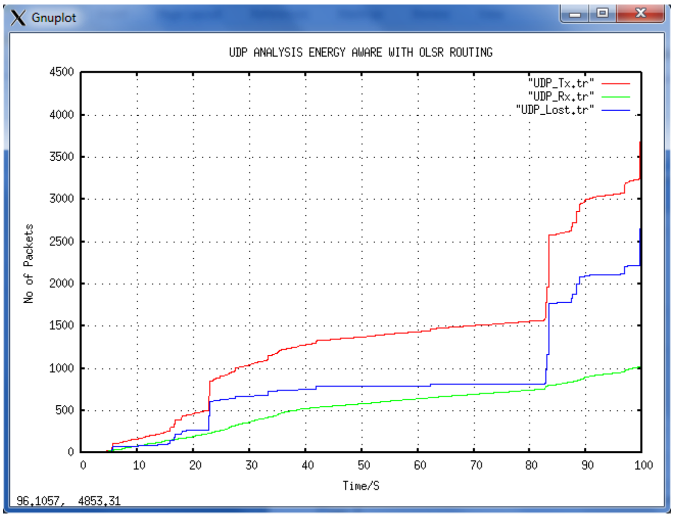

Fig. 4 Gnuplot for UDP transmission, Receiving and lost analysis

H. Gnuplot for Routing Overhead Analysis

Routing message overhead is calculated as the total number of control packets transmitted. The increase in the routing message overhead reduces the performance of the ad-hoc network as it consumes portions from the bandwidth available to transfer data between the nodes.

Here our routing packets nearby 42500 at the end of simulation according to graph plot our routing over head increased proportional to simulation time increases that conclude overhead increased if simulation time increases.

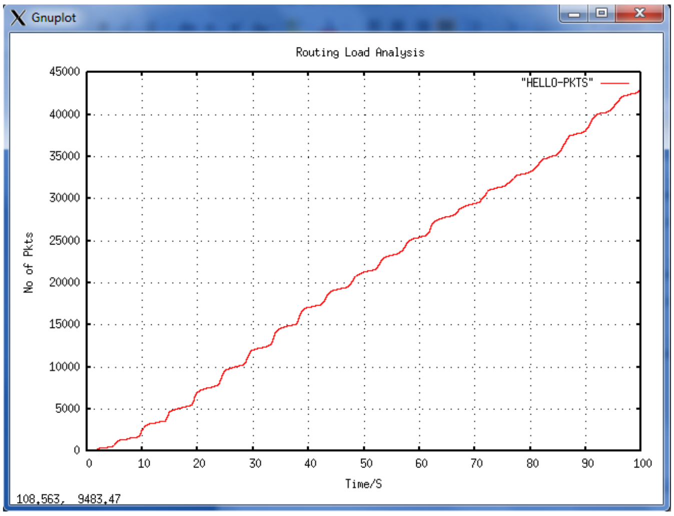

Fig. 5 Gnuplot for Routing Overhead Analysis

I. Gnuplot for Packet Delivery Fraction

Packet delivery fraction is a ratio of receives packets from packets sends at time unit. We formulize that

$$PDF = \left(\frac{Rx}{Send}\right) * 100$$

According to formula if our PDF is best that means our performance is very good, here our result shows at the end of simulation PDF value is nearby 81 %.

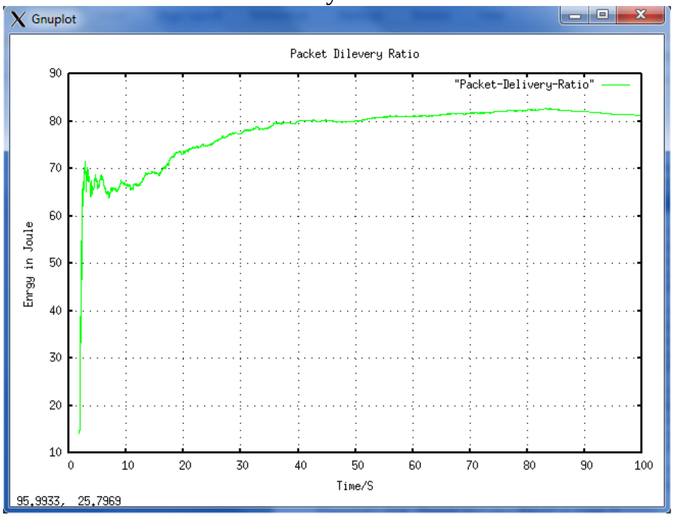

Fig. 6 Gnuplot for PDF Analysis

J. Energy Discharge analysis

Here in figure 7 we analyze our result through energy discharge graph, basically node energy discharge through transmission power , receiving power , ideal power and sleep power etc. if node energy less the 10 joule that means node are survival condition and route will updated means route change and if energy higher than the threshold 10 joule so new route establish.
Graph shows life time and energy discharge each node our life time is 100 second because energy utilize till end of simulation time and node survival condition after 90th second.

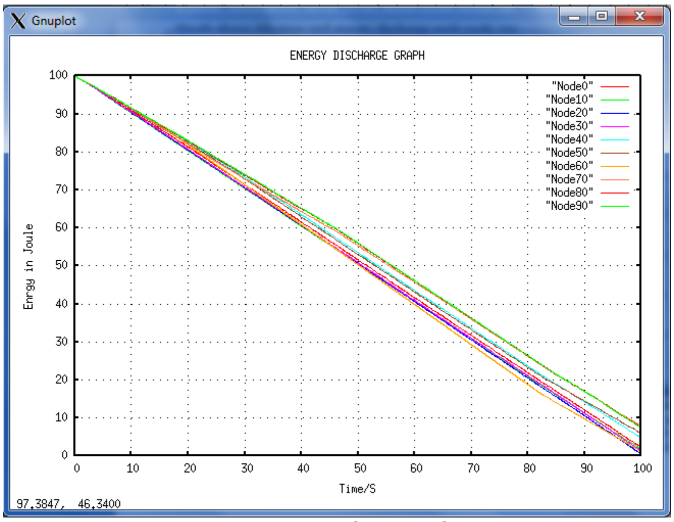

Fig. 7 Energy Discharge Analysis

1. ABOUT THE DEMONSTRATION

In this demo, we will analyze the result and energy utilization of the each node through transmission, receiving and sleep cases. Here we take only hundred mobile nodes and get the result after simulation using ns-2, we get information about routing load, TCP flow analysis, UDP analysis graph etc. In our simulation we use OLSR routing protocol and our proposed scheme provide accuracy of the network life time and efficient energy utilization of the node.

IV. CONCLUSIONS

In this paper, we simulate with in Energy Level Accuracy in Mobile Ad-Hoc Networks Using OLSR in ad hoc networks. Energy models widely used in analyzing ad hoc protocols were discussed. The sources of energy consumption that pertain to communications in ad hoc network were shown to exist in four main modes of operation: transmitting, receiving, idle and sleep modes. The sources of energy consumption overhead such as idle condition energy, that utilize via work as intermediate node and uses for data packet delivery to the destination node.

Here we show the conclude result table 3.

TABLE 3
OVERALL SUMMERY OLSR WITH ENERGY

PARAMETER	VALUES
SEND	16229
RECV	13191
ROUTINGPKTS	21525
PDF	81.28
NRL	1.63
Average e-e delay(ms)	488.8
No. of dropped data (packets)	2575
No. of dropped data (bytes)	2090140

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