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Location Based Proficient Recoiled Algorithm for Reliable Routing Protocol in Mobile Ad Hoc Network

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1. Abstract

As the rapid changes in technology of electronics and communication, the Mobile Ad-hoc Network (MANET) place an important place in the era of communication. The Communication must be reliable, fault tolerant and secure. To deal with these issues, the protocol used in the communication must be in great consideration in design. The routing protocol in Ad-hoc networks has been challenging task even since the wireless network came into existence. The reason behind it changeable topology along with the number of nodes, limited power back-up available in the network i.e. high degree of mobility and undefined size and shape. The transmission of packet during the communication with a desired reliability of the network as well as line paired among the nodes is major concern in the MANET. The protocol of routing algorithm plays a key role in the communication. In this paper we have calculated the same.

***Index Terms* – Mobile Adhoc Network, Multipath Routing Protocols, Mobile Adhoc Wireless Network, Reliability of nodes.**

2. Related Work

2.1. Multipath Routing in wireless sensor Network

Multipath Routing allows the establishment of multiple paths between a source and a destination, which provides an easy mechanism to increase the likelihood of reliable data delivery by sending multiple copies of data along different paths.
Several different multipath routing algorithms have been studied by the prior work. The Temporally Ordered Routing Algorithm provides loop free multiple alternate paths for mobile wireless network by maintaining a "destination oriented" directed acyclic graph (DAG) from the source. It rapidly adapts to topological changes, and has the ability to detect network partitions and erase all invalid routes within a finite time. Dynamic Source Routing (DSR) depends on query floods to discover routes whenever a new routed is needed.
Intelligent multipath extensions by Napsipuri and Das have been added to reduce the frequency of routing discovery flooding, while maintaining several disjoint alternate paths between source and destination. The Multipath routing protocol analysis in different topologies is one of the best solution to make the network more reliable and efficient [3].

2.2. Data Splitting across multiple paths

A way of increasing the reliability of the routing mechanism is to send the data packet across multiple disjoint paths. This way, even if some paths will fail, there is a higher probability that at least one data packet will reach the destination. The obvious drawback of this mechanism is the larger amount of traffic used.

2.3. Network Reliability

Two-terminal Reliability (2TR) is the popular metric for many reliability problems involving networks. For complex networks the efficient analysis methods are based on minimal path set enumeration and Monte Carlo Simulation. Feo and Johnson [2] provide a partial factoring technique that provides confidence bounds on two-terminal reliability. G. Hardy, C. Lucet, and N. Limnios, "Computing allterminal reliability of stochastic networks with binary decision diagrams [4]," The basis for reliability measurement of various decision diagram by G. Hardy, C. Lucet, and N. Limnios,[5] [6][7]. Simple enumeration of minimal cutsets technique to analyze the pair nodes by Ahmad S. H [9] is basic for the pairing of nodes and "A symbolic reliability algorithm based on path and cutset method [11] The for sum of disjoint products of nodes in Adhoc network is given by LOCK [10].

3. Proposed Model

The model is based on the reliability demand by the user and the system constraint. There may be one thing lost to achieve the others (tradeoff between two). It is the quality of the system to perform by making balance among the achieving and loosing things. Here the reliability can be improved by losing bit speed and the congestion in the network under consideration.

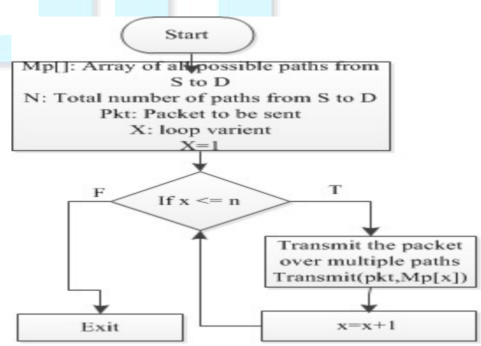

Fig.1

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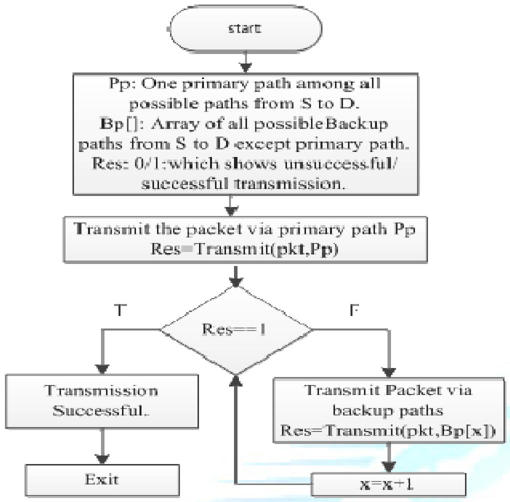

Fig 2.

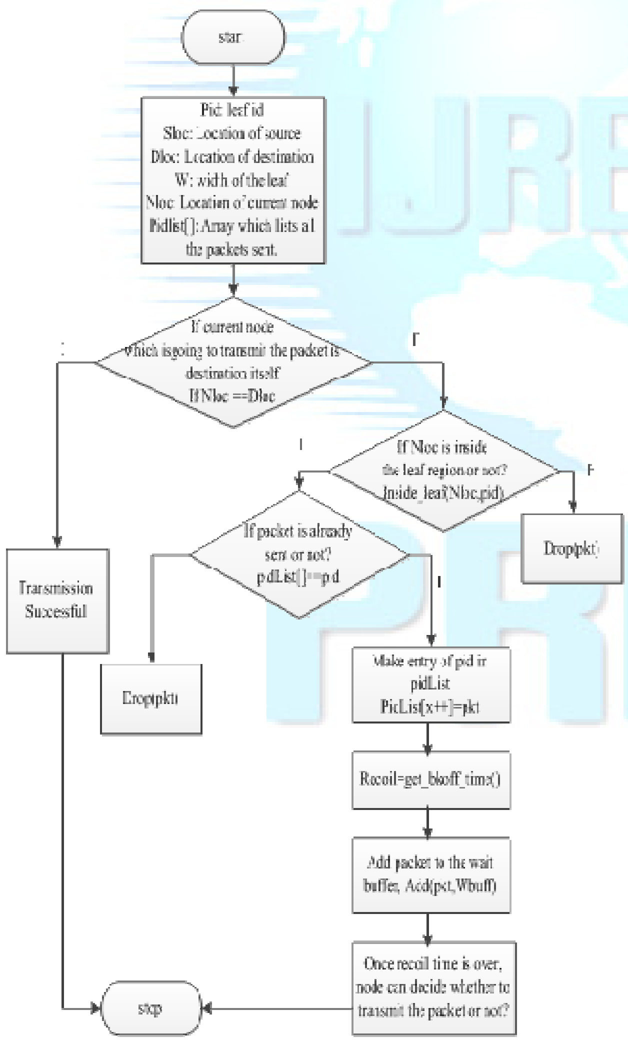

Fig 3.

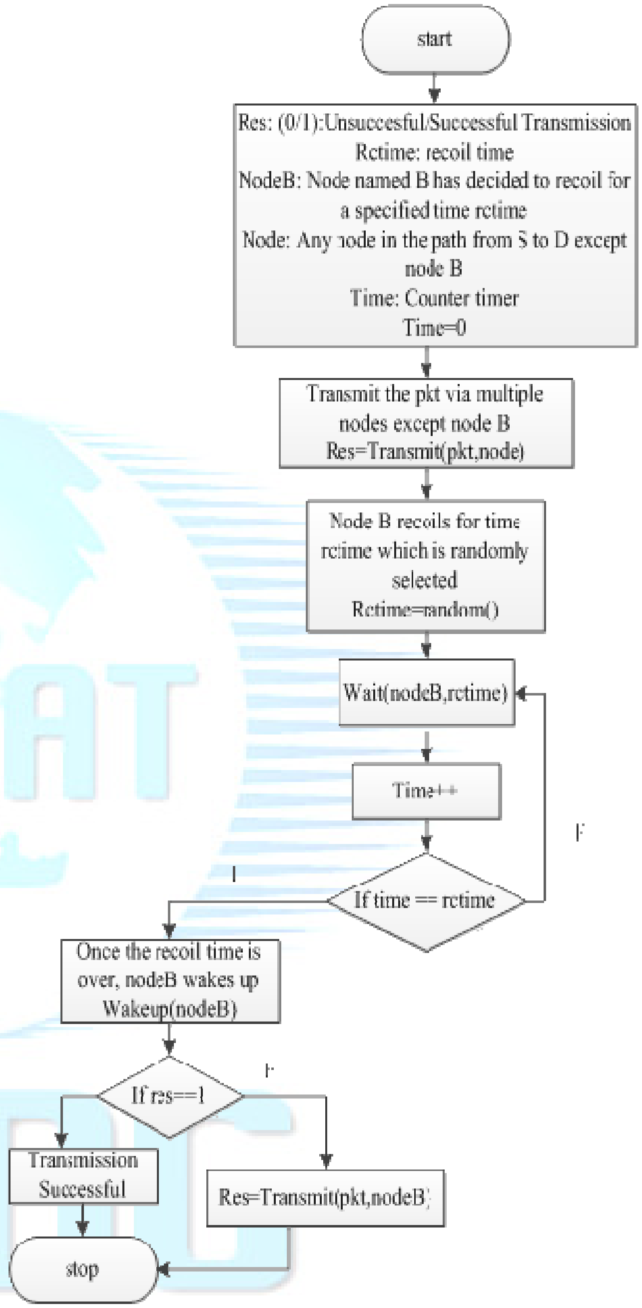

Fig 4.

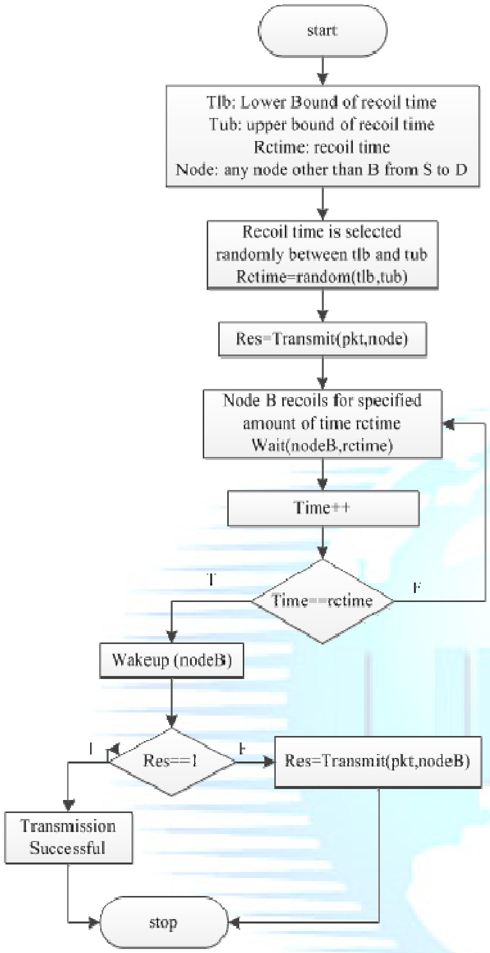

Fig 5.

4. Algorithm Design And Analysis

```
SMR_algo() {
        Mp[x]: list of all the path
        While(x < n) {
                Transmit(pkt,Mp[x++]);
        }
}

MRRecoil() {
        Pp: pri. Path
        Bp[x]: array of backup path
        Res: 0-fail,   1-success
        Res=Transmit(pkt, pri_path);
        If(res==1) {
        Success;  exit;
        }  else {
                While(res!=1  )  {
          Res=Transmit(pkt,Bp[x++])
                }
        }
}
Leaf_Routing() {
//transmit the packet
//Nloc: Location of the current node
//Leaf DataGram
// Pid- Leaf's  id
//Sloc-Source's  Location
//Dloc:Destination's  Location
//W: width of the leaf
If(Nloc==Dloc) {
        Trans_successful;
        Exit;
} else {
        //check if the node N is inside
        //the leaf or not
        If( inside  _leaf(Nloc,Pid)) {
                //if  pkt  has  already  been  //send  has
                already been //sent, then drop the packet
                If(pidList[ ]==pid) {
                        Drop_the_pkt;
                        exit;
                } else {
                        pidList[x++]=pid;
                   recoil=get_bkof_time();
                     //add packet to the
                     //wait buffer   WBuff
                      WBuff[y++]=pkt;
                }
        }else {
                Drop_pkt;
        }
  }
}//end-of Leaf_routing()
```

Recoil- Nodes in Leaf Routing:

All the nodes inside the leaf need not transmit. Instead some nodes should recoil (cancel the transmission). Recoil nodes can be categorized as random, co-ordinate and randomized coordinated recoil. In recoil node simply recoil the transmission for random amount of time and after the recoil time has elapsed, the node has to decide whether to transmit the packet or not. Here in random recoil, maximum delay occurs. In case of coordinated recoil, it is best to reduce the number of transmission. In figure-6 nodes 'A' and 'C' are transmitting the packet whereas node 'B' has recoiled).

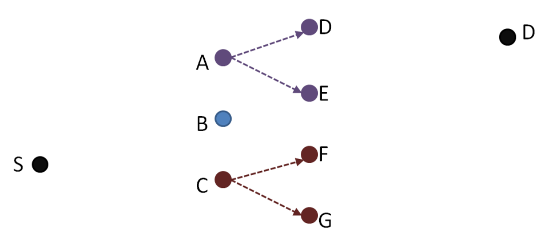

Fig-6

```
Random_Recoil() {
        rctime:recoil  time
        NodeB: node B has recoiled for time t
        //transmit the packet via some nodes
        //other than nodeB
        Transmit_pkt();

        //nodeB waits  for some time and
        //simply listens  to its neighbor then
        //decide whether to retransmit via
        //nodeB  again or not
        Recoiledoff(nodeB,rctime);

}

Coordinated_Recoil() {
//SDloc[]: co-ordinates of SD line
//Nloc:coordinates of node who
//wants to transmit
//eloc: some  error point

        If((Nloc + eloc ==SDloc) ||
        (Nloc - eloc ==SDloc)) {
                Transmit_pkt;
        }else {
                Recoil=randomTime( ms );

        }
 }
```

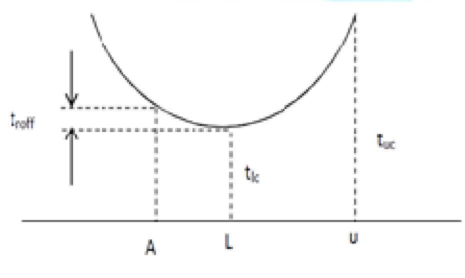

Fig-7.

In figure-7, where
t_{uc} = upper recoil time
t_{lc} = lower recoil time
t_{roff} = recoil off time

```
Randomized_Coordinated_Recoil() {
        //Tlb: Lower Bound
        //Tub:Upper Bound
        //rctime:recoiltime
        //NodeB: node B has recoiled for time rctime
        which is a random number between tlb and any
        point on then curve
        //transmit the packet via some nodes
        //other than nodeB
        Transmit_pkt();

        //nodeB waits  for some time and
        //simply listens  to its neighbor then
        //decide whether to retransmit via
        //nodeB  again or not

        rctime=random_time(tlb,ptoncurve)
        Recoiledoff(nodeB,rctime);

}
```

5. Analysis of lower recoil time (t_{lb})

id	S_{loc}	D_{loc}	T_{loc}	W	Payload

Fig. Leaf Header

Where :

id - Transmission Id

S_{loc} - Source Location

D_{loc} - Destination Location

T_{loc} - Address of node, where it got packet

W - Width of the Leaf

Payload - Actual message

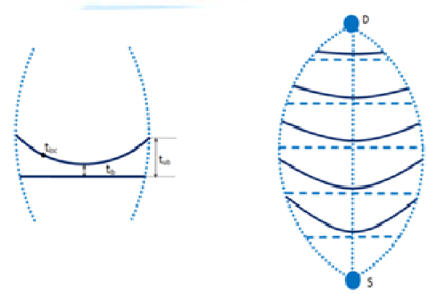

Fig. 8. Coordinated recoil off time

t_{ub} = upper recoil time
t_{lb} = lower recoil time
t_{rt} = recoil off time
t_{loc} = variable recoil time

The value of t_{loc} must be minimalized and that value gives the optimized solution to the objective function which is the optimized value for the source to destination time.
The single-variable objective function let f(t) has global minimum in $t=t_{loc}$ when

$$f(t_{loc}) \le f(t_{loc} + h) \quad \forall h$$

A single-variable objective function f (t_{lb}) has a local minimum in t= t_{lb} when

$$f(t_{loc}) \le f(t_{loc} + h)$$

for value of h sufficient close to 0. Therefore the single variable, single criterion optimization problem provides a way of selecting the "best" possible value of the input parameter (design or decision variable) to optimize the single criterion or objective function $f(t_{loc})$.

The minimization problem can also be expressed as

$$\min\{f(t_{loc}) = z\}$$

6. Minimum bandwidth required in this Mobile Adhoc Network path

The minimum available bandwidth in any of the link $(s,l_1),....,(k_n,d)$ on the path from node s to d.

$$b(s,d) = \min\{b(s,l_1), b(k_1,l_2),......b(k_n,d)\}$$

The optimal bandwidth metric $B(s,d)$ is the maximum available bandwidth on the path. This value can be given by

$$B(s,d) = \max\{b(s,d)\} = \max\{\min\{b(s,l_1),...b(k_n,d)\}\} \forall k,l$$

The available bandwidth on each link (k,l) in the path from node s to node d is = Bandwidth on the node- Routing overhead (on each link (k,l)).

$$b(k,l) = (B_N / n_e) - \Omega(k,l)$$

To maximize the available bandwidth on any link on the path

$$B_R(s,d) = \max\{b_R(s,d)\} = \max\{\min\{(B_N / n_e) - \Omega_R(M,N)_{kl}\}\} \forall k,l \varepsilon path$$

$$B_R(s,d) = \max\{b_R(s,d)\} = \max\{\min\{(B_N / n_e) - \Omega_p(M,N)_{kl}\}\} \forall k,l \varepsilon path$$

7. Reliability analysis in Network

The reliability of network is based on the successful communication and which intern depends upon the probabilities of

1) The successful communication between pair of intended nodes (known as two terminal reliability (2TR)), 2) the probability of required nodes must come in the leaf zone, which contribute in the successful communication.

Ability of network to perform error free operation under the unexpected fault encountered. These fault(s) may be temporary (e.g. due to link failure or over crowded information on a particular node etc.) or permanent in nature (due to jammer etc).The tolerance can be achieved by bringing out the redundancy either by path redundancy or hardware redundancy or by both.

2TRm calculation

The network is defined an each possible permutation of link states provides insight into the number of configurations the Mobile Adhoc Wireless Network (MAWN) may take on over time. The probability of each configuration existing may be determined as a function of the link probability of existence, λ, the number of linked node pairs, η_l, and the number of unlinked pairs, η_u, in the configuration. The probability associated with each possible configuration is given

$$P(\alpha_k = 1) = \lambda^{\eta_l} (1-\lambda)^{\eta_u}$$

Lastly, the $2TR_m$ can be obtained as weighted average of the probability for each configuration and the associated reliability for the MAWN. It can be expressed as:

$$2TR_m = \sum_{k=1}^{|C|} 2TR\alpha_k * P(\alpha_k = 1)$$

$$2TR_m = E[TR\alpha_k]$$

Conclusion and Future Work

In this paper we have designed the algorithms for the reliable routing protocol and further analyzed the various parameters to make the protocol more proficient and reducing bandwidth in the Mobile Ad-hoc network. We have also calculated the reliability of the network in concern with mobile nodes and the various links by considering linked node pairs. For future aspect of this algorithm the work is being tested on simulators and would be calculate the empirical results and compare with the theoretical one.

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