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LET'S GO:OPTIMAL NEIGHBOUR NODE SELECTION FOR ESTABLISHING RELIABLE PATH IN VEHICULAR NETWORKS

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ABSTRACT

InVanets, unstable links between vehicles causes interruptions during communication causes lot of inconvenience to safety and emergency applications, which affects overall network performance i.e. increases end to end delay and minimizes packet delivery ratio. Existing routing techniques usually selects intermediate nodes based on either link quality or link expiration time. In this paper, we proposed an efficient and reliable protocol for cluster based vehicular ad hoc networks uses meta-heuristic algorithm considering both Link Expiration Time and Expected Transmission Count metrics. Here our goal is to discover optimal neighbor nodes by exploring all possibilities based on current LET and ETX metrics of nodes. Simulation analysis shows LET'S GO protocol selects highly competent nodes to establish reliable path, so obviously performance of network increases, end to end delay is reduced and minimized route reconstructions.

***Keywords**: VANETs, node selection optimization, reliability, link stability, meta-heuristic, quality-of-service.*

I. INTRODUCTION

Vehicular ad hoc networks (VANET's) became as an interesting area of research due to lot of developments happening in the field of Intelligent Transportation System (ITS) such as road safety applications, entertainment and luxury applications. The increasing popularity of internet applications the demand grows for internet access by the services on vehicles such as GPS system, entertainment browsing and chatting [1]. Vanets can support critical safety applications. Such as collision avoidance, lane diverting assistance advertisements and emergency warning. Vanets can gather process and share information between vehicle to vehicle and vehicle to road side units. The Dedicated short range communication (DSRC) protocol [2] is used for establishing communication. Vanets are subset of Mobile ad hoc networks formed by group vehicles without any infrastructure, self-organising and intermediate nodes acts as routers to carry and forward packets along the path [3]. On other side due high mobility and relentless topology changes vanets are suffered with frequent disconnections between nodes results in short communication, so again another node should be identified to carry packets. Handling link breaks is crucial otherwise network performance woulddegrade in terms of packet losses and delay. Past three decades lot of research happened towards establishing stable paths using reliable intermediate nodes. Existing LLA [12] techniques used link stability index which is collected from neighbour nodes based on Packet delivery ratio another LGSR [13] used "Carry and forward"with local optimum packet delivery ratio and similarly rate estimation algorithms[15] used to identify best transmission rate and route selection algorithm to estimate direct link between nodes. Still there is no guarantee that nodes chosen using above techniques will remains consistent because if node consists high link stability but less participation time leads to path breaks. This motivates to develop "LETs Go" protocol in which node selection process depends on bothvehicle participation time and stability of link also meta-heuristic algorithm is used to select out optimal cooperative nodes using both LET and ETXmetrics.

II. LITERATURE SURVEY

In Existing GPSR [4] used greedy forwarding decisions to obtain information about immediate neighbours in the network. When a packet reaches a region where greedy forwarding is impossible then algorithm recovers routing using perimeter of the region. Based on local topology information GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. GPSR can use local topology information to find correct new routes quickly it uses location information to choose next hop for successively forwarding data until the destination is reached. GPSR focussed on end to end path connection but unstable neighbour nodes affects network throughput.

Similarlythe link state protocol [5] sends hello messages periodically to collect topology information,here total number no of retransmissions reduced, and link state protocol chooses optimal nodes in terms of no of hops which are immediately available on demand. The hello messages permit each node to learn the knowledge of its neighbours up to two hops.

To establish reliable path Link expiration time [6] is used where vehicles are grouped with their velocity to establish reliable single and multi-hop paths,here identification of reliable link is depends on LET here nodes with high link expiration time were chosen as cooperative nodes. Reliable route between source and destination based on their moving directions, but not on link stability. LMA-MAC [7] protocol used RTS and CTS control packets to select neighbour nodes initially network sends request-to-send signal to all nearby nodes and selects nodes based on reply clear-to-send signal from nodes. It uses location information includes position velocity and moving angle to know it neighbours information, It assumes nodes in network are moving with same speed.

In Block based routing [8] end to end reliable path formation is based on predicting the existence of candidate relay nodes. If the vehicle cannot identify a candidate relay node, then the data is rerouted to a different block. So "whenever link break occurs protocol does not attempt to create new route from the source vehicle instead re-routes the packet to a different block".In predicted routing [9] based on route lifetime path is established, this method pre-emptively create new routes before existing ones fail. By creating a new route just before the predicted route lifetime expires, the idea is to prevent route failures and make the most of the connectivity. When an old route breaks, a new route is constructed to the nearest gateway. If none exists, it broadcasts a route request (RREQ) packet with a time to live (TTL) value specifying the number of hops to search for a gateway that would have the required route. The route with maximum TTL is considered.

In carry and forward [10] routing approach vehicle carries the packet until a new vehicle moves into its area and forwards the packet. Different from existing carry and forward solutions vehicle mobility is limited by the traffic pattern and road layout. Based on the existing traffic pattern, a vehicle can find the next road to forward the packet to reduce the delay.VADD protocols used to forward the packet to the best road with the lowest data delivery delay. In Location based geographic routing and reactive routing[11],If no closer link is available(void region) then route request(RReq) packet is flooded to all neighbour vehicles until it reaches the destination vehicle if delay is more It buffers date and sends later. Scalability is the ability of the routing protocol to maintain its routing overhead rate less than network minimum traffic load.

In approach [12] linkstability is chosen as metric to improve the reliability of multihop communication to establish path between source and destination because applications such as real time safety services requires strong quality of service. E.g. Collision signals, safe drive, infotainment services. To build path with minimum disturbances author worked on link stability index collected from neighbour nodes based on packet delivery ratio and the node with high index probably choose for data transfer. Similarly Carry and forward andPerimeter forwarding [13] used local optimum Packet delivery ratio, LSGR achieves up to 9% and 22% improvement in packet delivery rate than GyTAR and GpsrJ+, respectively. In LSGR, the next hop is selected by integrating the link's state and the geographic distance.

The improved greedy strategy [14] predicts the position of each neighbour Chooses closest to the destination and selected as next hop, But the link between the neighbour and the forwarder may face a high packet dropping ratio due to the far distance between the two nodes Moreover, in GyTAR, the recovery strategy is only based on the idea of 'carry and forward', whereas LSGR incorporates the idea of 'carry and forward' and the perimeter forwarding. The rate estimation and route selection [15] algorithms used to identify best transmission rate for establishing direct link between hops. Data rate, multihop data transmission efficiency and vehicle mobility have a significant impact on the performance of routing protocols. The performance of multihop network drastically drops if the end to end communication route is not properly selected.

III. PROPOSED SYSTEM

In proposed system we used both link Expiration time and Link Stability metrics below we have presented brief introduction about LET and ETX .Traditional routing techniques uses hop count to choose best path between source and destination, if multiple paths exists between sender and receiver with same hop count randomly one will be selected as path but this idea is not feasible for dynamic networks like VANET's. The reason is high node movements cause lotofinterferences for communication which is not acceptable. Hence it is essential to choose nodes based on link quality, the path which contains nodes with good link quality contributes high packet delivery ratio.Earlier"De Couto et al" used ETX (Expected Transmission Count) metric [16] to estimate link quality , Here ETX of the link is estimated on the basis of number of retransmissions required to send over the link , quality link contains smaller value of ETX.ETX of path is defined as sum of the ETX of each link between source and destination.

Procedure Calculate-ETX(V-ID,Position,Direction,Hopcount)
{ // to find no of retransmission required

$$ETX = 1/D_F * D_R.$$

D_F = Probability of a packet delivered
D_R = Probability of a packet Acknowledged

Return(Tcount)
}

In research [8] author used LET (link expiration time) for node selection in order to construct reliable path between source and destination. Here node maximum link expiration is selected.R_n and R_c denotes new and current relay nodes and each node maintains a table in which all neighbor's like position , velocity and movement direction information is stored and updated regularly by sending hello messages to nearby nodes.

Procedure Calculate-ETX(V-ID, Position,Direction,Distance,Neighbour nodes array)
{

$$LET = \frac{T_r - |D_n|}{|V_n - V_c|}$$

T_r - Transmission range of nodes
V_n & V_c - Velocities of new and current nodes
D_n & D_c - Distances

Return(let)
}

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Still there is an opportunity to improve further byconsidering both link quality and link expiration timemetrics becausein existing when node identified with minimum packet retransmissions as a cooperative node assuming linkhas quality, if chosen node has less expiration time might cause again link breaks which degrades network performance. To overcome this problem, in this paperwe use Metaheuristicalgorithm (MHA) to find nodes with high probability of success considering LET and ETX metrics of neighbour nodes. In proposed table is updated whenever changes happened in network.

Node selection based on ETX and LET

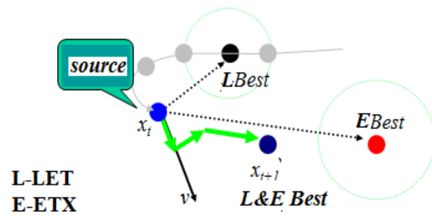


Figure 1. Shows node selection process

IV. METHODOLOGY

1. Initially clusters are formed by grouping vehicles based on position and direction maximum each cluster contains 20 to 30 vehicles with one node as cluster head (CH).
2. CH is responsible for storing and updating information related to clusters members like id, position, distance, link expiration time, retransmissions count.
3. Whenever path is required to establish between source and destination, CH chooses suitable neighbour nodes based on present network conditions.
4. Here selecting optimal node process is crucial, in our proposed methodology Metaheruisticalgorithm is used to trace highly competent nodes between source and destination. In MHA we used basic local search, it constantly collects ETX and LET information of nodes in cluster from CH and realistic solutions called first set andoptimalset based on feasibility CH chooses nodes with optimal values to establish path.
5. Finally same process repeats until packets reach desired destination.
6.

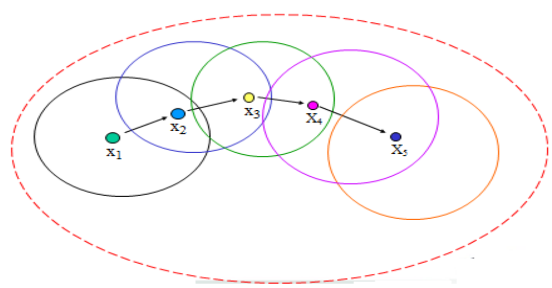


Figure 2.Node selection process.

Procedure Meta- heuristic procedure (vehicles [max], ETX [max], LET [max])
{
// get nodes with max LET & Min ETX as
S ← initial solution (V_I, Let_I ,Etx_I);
While (1)
{ // finding nodes with good stability.
S ←improve (N(S)) // new set of stability nodes using recent updates.
}
}

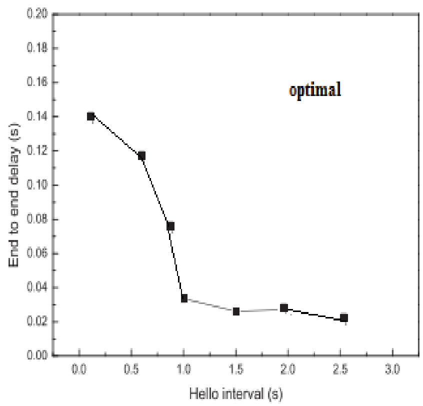
V. SIMULATION PARAMETERS

Table-1 Shows simulation parameters

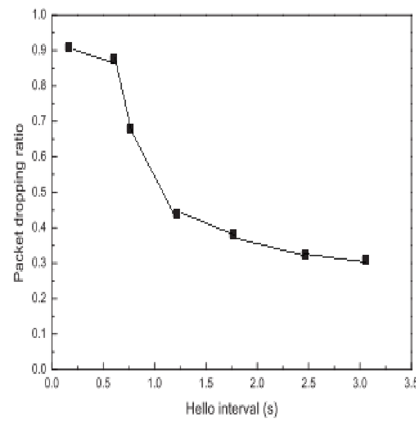
Parameter	**Intial set of values**
Mobility model	**VanetMobiSim**
Number of vehicles	**50 to 100**
Vehicles speed	**80kmph**
MAC Protocol	**IEEE 802.11**
Propagation model	**Two-ray ground model**
Channel rate	**2 Mbps**
Hello packet interval	**1 sec**

VI. RESULTS AND PERFORMANCE EVALUATION

In this section, figure 3 and figure 4 shows initially packet dropping ratio is high gradually this ratio decreases with selection of optimal neighbour nodes in turn over all end-to-end delay is reduced both because node with max- LET and min-ETX combination guarantees consistency. Finally path made with optimal nodes results in high packet delivery ratio and provides reliable communication



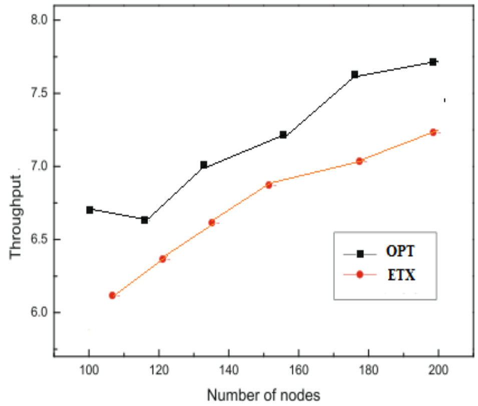
End-to-end delay



Packet dropping ratio vs. the Hello interval.

Figure 3 & Figure 4

Figure 5 and Figure 6 shows that optimal node selection improves throughput of network compared with exiting techniques. The high quality links increases packet delivery ratio and reduces wastage of bandwidth for retransmissions also at beginning due to initial calculations throughput graph went down because later performance improved as shown below. Initially some sort of delay occurred but later on reduced



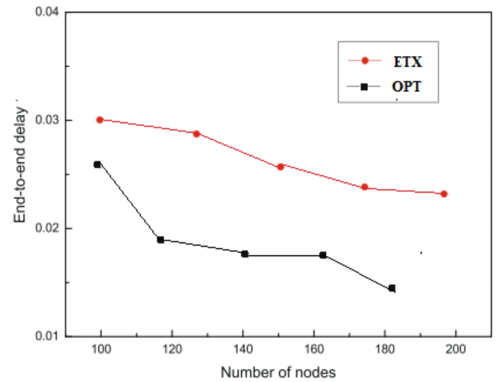


Figure 5 & Figure 6

VII. CONCLUSION

In this paper optimal node selection (LETs Go) method uses both expected transmission count and link expiration time factors to improve routing between source and destination nodes in cluster based vehicular networks, this method selects neighbour node with high link quality to reduces frequent path disconnections. Comprehensive analysis proves that Lets-Go protocol outperforms in aspects of packet-delivery-ratio and throughput of network

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REFERENCES

1. *Bhagirath and khushbu .A survey on vehicular a hoc networks, IOSR journal of computer engineering,2013 Dec, PP – 34-42.*
2. *Palazzi and Roccetti. An inter-vehicular communication Architecture for safety and entertainment,MoMA and DAMASCO initiatives, 2007 July.*
3. *Dahiya and Chauhan. A comparative study of manet and vanetenvironment ,Journal of computing2010.*
4. *Brad Karp and H.T.Kung.GPSR:Greedy Perimeter StatelessRouting for WirelessNetworks, MobiCom 2000.*
5. *P.Jacquet , P. Muhlethaler.Optimized link state routing protocol for ad hoc networks,Multi TopicConference, 2001. IEEE INMIC 2001. Technology for the 21st Century. Proceedings. IEEE international.*
6. *Taleb, Sakhaee and jamalipour.A Stable Routing Protocol to Support ITS Services in VANET Networks,2007 November ,PP 3337-3347.*
7. *Kai Ten Feng. LMA: Location- and Mobility Aware Medium-Access Control Protocols for Vehicular Ad HocNetworks Using Directional Antennas, IEEE transactions on Vanets ,2007 Nov.*
8. *Jung-Hun Kim and SuKyoung Lee .Reliable routing protocol for Vehicular Ad Hoc Networks , Int. J.Electron. Commun. (AEU) 65 (2011) 268–271.*
9. *Vinod andLixin. Prediction Based Routing for Vehicular Ad Hoc Networks, IEEE Transactions onvehicular technology , 2007 July PP- 233-2345.*
10. *Jing Zhao and GuohongCao . VADD: Vehicle-Assisted Data Delivery in Vehicular Ad Hoc Networks IEEE Transactions on Vehicular Technology (Volume:57, Issue: 3) 2008 May.*
11. *Mohammad Al-Rabayah and Robert Malaney.A New Scalable Hybrid Routing Protocol for VANETsIEEE transactions on vehicular technology , VOL. 61, NO. 6,2012 July.*

12. *JacekRak "LLA: A New Any path Routing Scheme Providing Long Path Lifetime in VANETs"IEEE COMMUNICATIONS LETTERS, VOL. 18, NO. 2, FEBRUARY 2014.*
13. *Changle , Wang, Ying He, Zhao, Hang Lin and Lina Zhu .A link state awaregeographic routingprotocol for Vanetseurasip journal on wireless communications and networking,2014 Dec.*
14. *Jerbi and Meraihi .GyTAR: improved greedy traffic aware routing protocol for vanets in city environments, international workshop on vanets , 2006 Sep PP 88-89.*
15. *Celimuge and Yushen. Towards practical and intelligent routing in vehicular ad hoc networks, IEEE Transactions on vehicular technology, 2015 Sep.*
16. *De.couto ,aguayo and Bicket. A high throughput path metric for multi hop wireless routing ,ACM,2003 ,pp-134-146*