Improving Frequent Link Failure Detection in VANET

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Abstract

VANET technology integrates wireless cellular and ad hoc for seamless connectivity between vehicles. Vehicle ad-hoc networks (VANETs) are systems that allow vehicles to communicate with each other. Wireless-vice can send information to nearby vehicles, and messages can be sent from one vehicle to another, so that the information can be spread throughout the city. In the network, there is a link failure very common due to the high mobility of nodes in the network region available. So what makes frequent link failure that packets do not reach the respective destinations. The mechanism proposed here establishes a kind of route discovery packet parallel to the real time application to be delivered to the destination, while minimizing losses. The main objective is to establish parallel paths during link failures scenarios for real-time applications to provide data to their destination safely. Recovery road parallel fixed temporary parallel path between nodes when link failure. The node before the link failure packet buffers, after setting the new parallel paths before the packets stored in the buffer via the destination newly created path.

Key words: VANET, AODV, AOMDV, FROMR, buffer, parallel path.

1. Introduction

The main focus is to propose a new method for route recovery process that provides efficient routing when there is link failure and also to avoid congestion in network during link failures. This paper mainly deals with a temporary parallel route recovery mechanism during link failures and about the performance metrics. There are many problems in vehicular adhoc networks like frequent link failures due to the high mobility of nodes. Here the topology is high dynamic topology the vehicles will be moving with high speed, the topology formed will be always changing. The packet loss will be high, the packets does not reach destination due to frequent path breaks.

Generally in VANETS each and every node acts as a router in forwarding packets from source to destination. There is chance that the packets may not be delivered, that is they may be dropped because of some reasons. The lost data cannot be recovered back from the intermediate nodes during link failures, the lost packets can be retransmitted on request from source. To overcome the drawback we found a solution in proposed method. The temporary parallel path takes the better route from source to destination so the transmission delay can be minimized when there is route failure.

There are many routing protocols for adhoc networks like AODV, DSR, TORA and DSDV. Among all AODV is important on-demand routing protocol. AODV protocol establishes route for source node when there is data for transmitting. The AODV has phases like route discovery, route maintenance and data delivery. Simulation results for protocols like AODV, DSDV, TORA, DSR are found in many papers have summarized that AODV performs better when compare to all. AODV gives better performance in following metrics: packet delivery ratio, routing overhead, path optimization. The proposed system is the enhancement of AODV. In the proposed system “On demand temporary parallel route recovery for link failure” gives better performance when compared to AODV.

2. Related Work

In “On demand temporary parallel route recovery for frequent link failures in MANETS”, [1] the author proposed a mechanism which propagates a parallel route discovery when there is a frequent link failures. The mechanism is proposed in order to save data losses during link failures. The packets are stored in buffer at nodes when there is link failure and buffered packets are delivered through new route established.

In “Enhancing AODV routing protocol using mobility parameters in VANET”, [3] the authors proposed an enhanced routing protocol by enhancing AODV. They enhanced AODV protocol to make it adaptive to vehicular adhoc networks (VANETS). In their paper they took direction and position as important parameters in choosing next hop in route discovery phase. The main objective of the proposed protocol is to establish a new stable route in VANETS.

In "Design of Fast Restoration Multipath Routing in VANETs",[6] the authors proposed a multipath routing protocol for VANET and they named it as *Fast Restoration On-demand Multipath Routing* (FROMR), The FROMR protocol mainly focuses on rapidly establishing an alternate path if the original route is broken. In order to reduce the amount of control messages as well as increase the path robustness, The FROMR protocol divides the geographical region into squares of equal sizes called as grids. In each grid, the vehicle that is expected to stay for the longest duration is selected as the grid leader. Only grid leaders are responsible for route discovery, maintenance and restoration during link failures.

In "An Optimized Ad-hoc On-demand Multipath Distance Vector (AOMDV) Routing Protocol", [7] the author proposed an optimized AOMDV that solves the "route cutoff" problem in AOMDV by using a control packet RREP_ACK. RREP_ACK control packet is defined in AODV, but in general it is ignored. Here they used it in the OAOMDV protocol. Even though the proposed routing scheme increases an additional routing packet, the simulations show that the routing overhead is decreased. The performance metrics such as packet loss, route discovery frequency, and average delay has been improved.

3. Proposed System

The proposed method is a new parallel route recovery concept for buffering the packets and then transmitting packets that are dropped by intermediate nodes during link failures. Delays that occur by the link failures are minimized by allocating buffers at the intermediate nodes. Each node that carries time sensitive critical data is allotted with buffer that holds the data that is dropped during link failures. As soon as the alternate route is recovered the data at intermediate nodes is transmitted through that link.

When the sender wants to send time critical data to destination and finds frequent link failures for it then it generates TRREQ (temporary route request) packet and broadcasts it to neighboring nodes. The TRREQ uses the fields like hop count, TPRREQ ID, destination IP address, source IP address destination sequence number and source sequence number. The hop count is number of hops require the source to the node handling the TPRREQ. Hop count increments by 1 till it finds the destination node. TPRREQ ID is a unique ID number which identifies request i.e., TPRREQ. If the TPRREQ ID in the packet matches with the TPRREQ ID in the nodes route entry table then the TPRREQ ID will be dropped if that node is not the destination node.

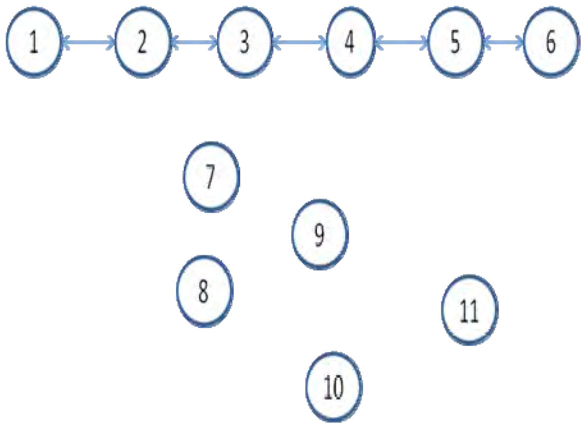


Fig 1: Delivery of packets from node 1 to node 6 when there is no link failure. [8]

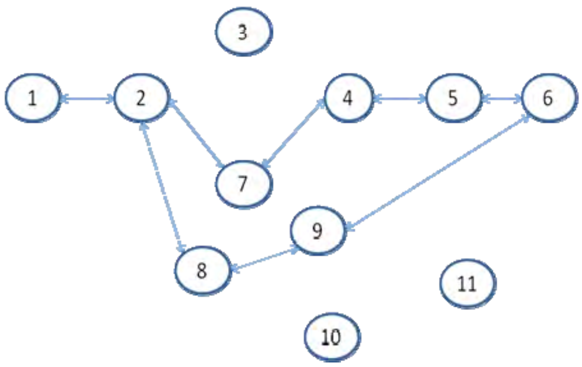


Fig 2: Link failure at node 2 due to moving of node 3 away from transmission path.[8]

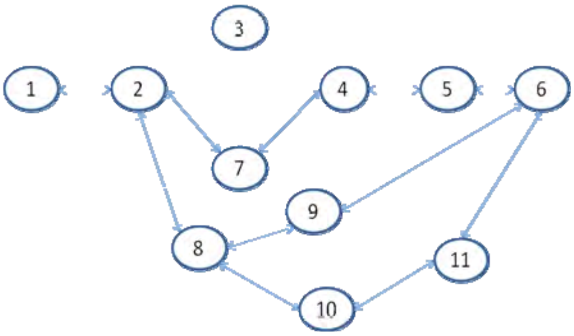


Fig 3: Temporary parallel path for delivery of packets from node 1 to node 6 when there is link failure. [8]

Algorithm : Route Discovery:[8]

Route Request (RREQ) & Route Reply (RREP):

If packets are to be delivered from source to destination Then

{

Broadcast RREQ to all nodes N

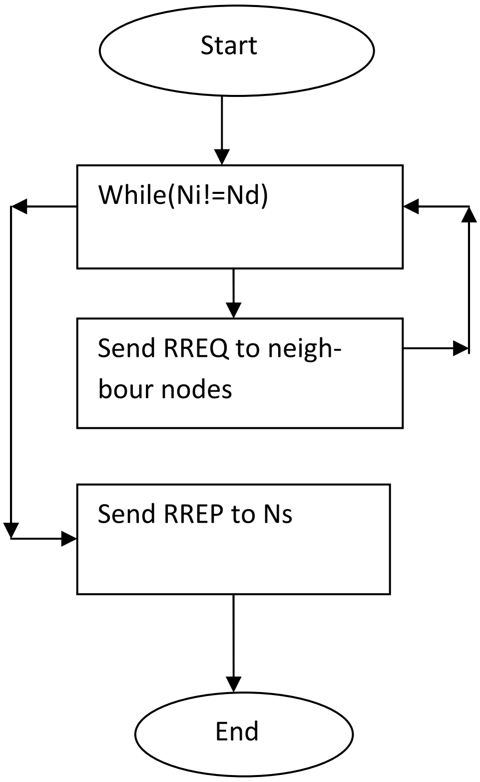
If (Node Ni = Destination D){

Send RREP to Source Node S,

}Else {

Broadcast RREQ to neighbor nodes }}

Flow chart for pseudo algorithm given



If(Packet to send){While(Nn!=Nd){Nn->RREQNn=New Nn}Ns->RREP}

Terminology used in algorithm:

Let V={v1,v2....vn} where V is the set of nodes in the network, if u,v are nodes then (u,v) is the path connecting u and v. Assuming capacity is required to determine the flow of packet from one node to another, Let us take c as the capacity parameter with default value 1 and during link failure it turns to 0. i.e

$$C(u,v) = 1 \ \forall \ (u,v) \in V$$

Let R be the route from source to destination such that R={r1,r2...rn} , where r1,r2...rn are nodes added to the route. RREQ – Route Request

Algorithm (Considering link failure)

ROUTE-DISCOVERY(V,R,c)

Input: V={v1,v2....vn} where V is the set of nodes in the network, R={r1,r2...rn} , where r1,r2...rn are nodes added to the route, Capacity c whose default is 1, RREQ

Flow of algorithm

If packets are present to be sent -> Until destination node is not found -> if no link failure present -> Add the current node to ROUTE -> Else if link fails -> Find the neighbour node/s and send RREQ ->if destination found return R which is the RREP value.(as R contains route from source to destination)

Route Maintenance:

1. If there is link failure notify to source S by sending RERR message.
2. Establish new parallel path from source S to destination D.
3. Transfer the packets that are stored in buffer at intermediate during link failure.

When the destination node receives the TPRREQ packet, it prepares the TPRREP (reply packet) and increments its current destination number by 1 and forwards the TPRREP packets to the source through the nodes from which it received the TPRREQ packet at first. The source node waits for fixed amount of time for the TPRREP. If it does not arrive on time then it retransmits TPRREQ up to predefined number of times. If the response from destination is not arrived then source declares that the destination is not reachable. If the TPRREP is received then it allocates buffer to all the nodes that take data to destination in order to avoid data losses during link failures due to high mobility of nodes. So, if there is any link failure then the data is stored at the intermediate nodes and after creating a new temporary parallel path then the buffered data is transmitted.

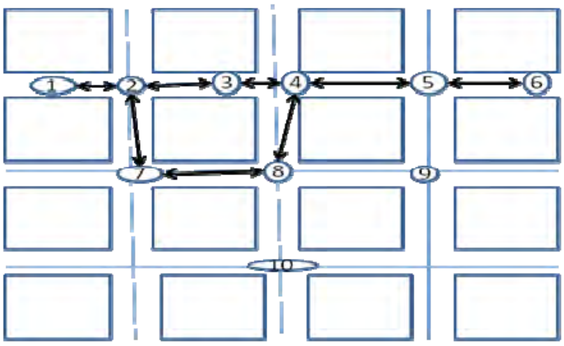


Fig -1 Manhattan model

Temporary parallel route is calculated as soon as there is a link failure. When there is link failure at the time of transmission a route error (RERR) message is sent to the source node so that the source again retransmits the data. When there are link failures at intermediate nodes our temporary parallel route discovery helps us to find a new temporary parallel path to the destination to transmit the data that is buffered at the intermediate nodes.

We use the following metrics to evaluate the performance of the temporary route recovery mechanism packet delivery ratio, routing overhead and average delay.

4. Conclusion

When there is any link failure during packets transmission the temporary parallel route recovery scheme is introduced. We can get better results in packet delivery ratio, average delay time i.e., the difference between the packet receive time to packet sent time in temporary parallel route recovery scheme when compared to AODV. The routing overhead can be decreased because of maintenance of buffer space at nodes.

References

[1] Amit D.Kothari and Dr.Ashok R.Patel, "On Demand Temporary Parallel Route Recovery for Frequent Link Failure in Adhoc Networks" International Journal of computer applications(0975-8887) volume 11-No.11,December 2010.

[2] Charles E. Perkins, Elizabeth M. BeldingRoyer, and Samir Das. "Ad Hoc on Demand Distance Vector (AODV) Routing" IETF internet draft, draft-ietfmanetaodv-10.txt, March 2002.

[3] Omid Abedi, Mahmood Fathy, Jamshid Taghiloo. "Enhancing AODV routing protocol using mobility parameters in VANET" IEEE, 2008.

[4] Sandhaya Kohli, Bandanjot Kaur and Sabina Bindra "A comparative study of Routing Protocols in VANET". Proceedings of ISCET 2010, ISBN: 978-81-910304-0-21.

[5] C. Perkins, E. Belding-Royer, and S. Das, "Ad hoc On- Demand Distance Vector routing," RFC 3561, July 2003.

[6] Cheng-Shiun Wu, Shuo-Cheng Hu, Chih-Shun Hsu, "Design of Fast Restoration Multipath Routing in VANETs", 2010 IEEE.
[7] YuHua Yuan, HuiMin Chen, and Min Jia, "An Optimized Ad-hoc On-demand Multipath Distance Vector (AOMDV) Routing Protocol", Asia-Pacific Conference on Communications, Perth, Western Australia, 3 - 5 October 2005.
[8] B.siva kumar reddy, M.sakthi ganesh, p.venkatakrishna," Temporary Parallel Route Recovery for Frequent Link Failure in VANET ,NECOM 2012-Advances in Computing and Information Technology -Advances in Intelligent Systems and Computing, 2012, Volume 176, 369-374, DOI: 10.1007/978-3-642-31513-8_38