A Reliable **Routing Protocol for VANETs (RRPV)**

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Abstract— Routing plays important role in VANET application but due to rapidly changing topology and high speed mobility of vehicle conventional routing protocol suffer heavily. Current MANET routing protocol is not able to fulfill the needs in VANET one of the critical issues consist of the design of scalable routing protocol that are robust to frequent disconnection of link breakage in this proposed protocol avoiding a continues link breakage by making a link stable means source will select intermediate node (make link) according to link expiration time (LET) of link and means whose LET is maximum that Path will select for forwarding packet. In this protocol we are assuming that all vehicles (nodes) equipped with GPS and know information (position, speed, direction) of itself and neighbors node and destination node and this protocol will choose intermediate vehicle for forwarding data as a greedy manner and for the worst case if there is no suitable neighbor in that situation the recovery method will use store-carry-forward strategy.

Index Terms —V2V (vehicle to vehicle), LET, GPS, V2I (vehicle to Infrastructure).

1 INTRODUCTION

Vehicle ad-hoc network is a special case of mobile ad-hoc network MANETs, its share information among neighboring vehicle (V2V vehicle to vehicle) and vehicle to infrastructure communication means it can share information roadside through unit (RSU) is call V2I (vehicle to infrastructure communication). The main aim of VANETs is provide safety and comfort for passenger. But now vehicle communication is useful for one more main area that is entertainment application like internet access, gaming, music and e-commerce and some other application. All vehicle ad-hoc network networks (VANET) are based on short range wireless communication (e.g. IEEE 802.11) for the use in driver safety and many other commercial applications.

Dedicated short range communication (DSRC) is used for vehicle to vehicle and vehicle to infrastructure communications. The radio range for VANET is several hundred meters, typically between 250 to 300 meters. It is expected that more vehicles would be equipped with processing capabilities and wireless communication devices in the future. We assume that vehicle should be equipped wireless communication devices, digital maps and optional sensors for reporting vehicles condition. Vehicle exchange information with other vehicle as well as road-side infrastructure with their radio ranges. Many project like CarTALK2000 [1] or other FleetNet-Internet on the road [2] has been developed based on the concept of MANETs and VANETS. For multi-hop communication we need routing algorithm. Routing in VANET is different from MANET due to the characteristic of VANETs e.g. high dynamic mobility constraints, high speed of vehicles.

On the other hand in VANET we do not have limitation of less computation power, limited battery. Therefore these factor provide us with potential to make use of these characteristic to make use to develop more improved routing protocol. High dynamic in large scale network will lead to uneven network density which varies by time and location. It means that network might be sparsely connected one area but densely connected in other area on the other hand some characteristic of VANET, like mobility constraints and predictable provide the opportunity to facility routing in VANETs.

Mainly two type of routing strategy used in wireless multihop networks topology based and position based for forwarding data in multihop wireless network. In topology based routing protocol each node has to maintain the routing table and has to share routing information at particular period of time in that case lots of packet has to spread on network for maintaining the routing table. In position based routing protocol assume that every nodes are aware of its location and neighbor vehicle location and the destination vehicle location in that cause exchanging of data packet is reduced and control overhead will be less. With increasing the availability of GPS enable vehicle position based protocol are giving more accuracy and convenience actually position based routing protocols are designed for MANETs it cannot directly applied in VANETs environment but modify the MANET protocol and make it suitable for VANETs because VANETs is special cause of MANETs. There are many routing protocol are used in vehicle networks one most usable and important routing protocol is AODV.

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2. RELATED WORK

For routing mainly two types of protocols are used proactive and reactive routing protocol but for the wireless network (like MANETs and VANETs) reactive based routing protocols are giving better performance and accuracy in wireless network various approaches have been proposed to address the problem of multi-hop routing in mobile ad-hoc networks MANETs. In VANETs, routing protocol should be sturdy, reliable and minimize the latency and the network load. Several simulation studies have been conducted to better study the performance of routing protocol. AOMDV (ad hoc wireless multicast with mobility prediction) protocol is extension of on demand routing algorithm (AODV). Performance of AOMD is much better than AODV [9][10]. AOMDV is able to find node-disjoint paths and link-disjoint path when discovering routes. Because the condition of node-disjoint paths the number of node-disjoint paths is less than that a link-disjoint paths. Thus link-disjoint policy is used more popular.

After multipath is found, AOMDV will store all the paths in routing table. The source node will select one path according to timestamp. The first selected forward path is the earliest established one. For route maintenance, when a route failure is detected, packet can be forwarded through other paths. To ensure the validity of routes, timeout mechanism is adopted. The Hello messages are broadcasted to remove expired rotes.
As AODV, AOMDV is also an on-demand routing protocol. When a source node want a route packet to destination, and if there are no paths are available than source node will broadcast RREQ (route request packet) routing packet to initiate a route discovery process. It is possible that other may receive duplicate RREQ packets because of flooding. When this case happened other nodes will establish or update multiple reverse paths according to different first hops of RREQ packets. However AODV will establish a reverse path using first RREQ packet and other duplicate RREQ packets are discarded.

After establishing reverse paths intermediate nodes will search their routing tables for an available forward path to destination node. If path exists, an RREP packet will be sent back to source node along a reverse path and the RREQ packet will be discarded. If the path does not exist and the intermediate node does not forward other duplicate RREW packets, the RREQ packet will broadcasted. When destination node receive RREQ packet, it will establish or update reverse path too. However destination node will reply with looser policy the destination node will reply all RREQ packets from different neighbors although the RREQ packets posses same first hop. Different RREP packets will be sent back through different neighbors, which can ensure link-disjoint path establishment. After passing by different neighbors, RREQ packets will be sent to source node along link-disjoint reverse paths. When intermediate and source nodes receive RREP packets, they will establish loop-free and link-disjoint paths to destination node according to different first hops of RREP packets. For intermediate nodes that are shared by different link-disjoint paths, they will check if there are unused reverse paths to the source node. If so, one reverse path will be selected to forward the current RREP packet; otherwise, the packet will be eliminated.
A Stable Routing Protocol to Support ITS Services in VANET Networks [6] to predict a possible link-breakage event prior to its occurrence scheme presented also reduces the overall traffic in highly mobile VANET networks. Mobility Prediction and Routing in Ad Hoc Wireless Networks[7] in this paper using LET(link expiration technique) to predict the link expiration time according to that vehicle can decide whether data send through vehicle or not and in the cause where GPS will not able to give exact value due to the environmental effect alternative method is used.
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3. Problem Definition

In VANET, routing is very challenging due to high mobility of vehicle, in this paper main focus on continuous link disruption due to the high mobility of vehicle and making connection again and again will lead delay and more control overheads and data will lost when link expire, ongoing data lost because of link breakage and packet delivery ratio will decrease so in this proposal trying to reduce the delay while establishing link between two nodes making link stable means before the link expire we know the time when link will expire, before that another stable link will select for forwarding data in this way ongoing data will not loss and it can improve packet delivery ratio. and for the worst case when there is no suitable neighbor for making stable link, store and carry forward mechanism will apply.
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4. Proposed Model

This algorithm will select forwarding nodes according to the speed direction and position of neighbor it is believed that this protocol would further enhance the stability and further reduce network flooding and control overhead in VANET networks.
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4.1 System Model

In this protocol we are assuming that all vehicles are equipped with a GPS (Global Positioning System), and preloaded electronic map and wireless transceiver. A vehicle is able to get its information like position direction speed through GPS. Vehicle also able to get neighbor vehicle information -

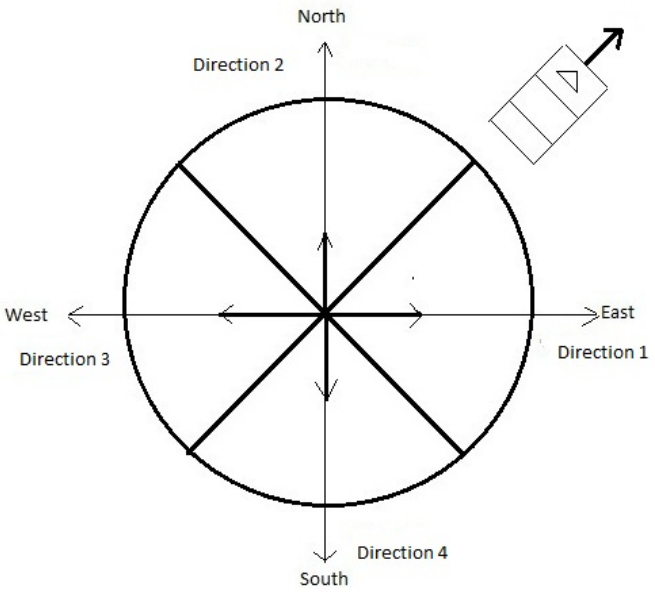

Fig - velocity vector

Information position direction speed through GPS or V2V and V2R communications the communication is based on IEEE 802.11p protocol [5]. Based on GPS information obtained by source vehicle will calculate the link expiration time and based on speed direction and position of neighboring vehicle [6].

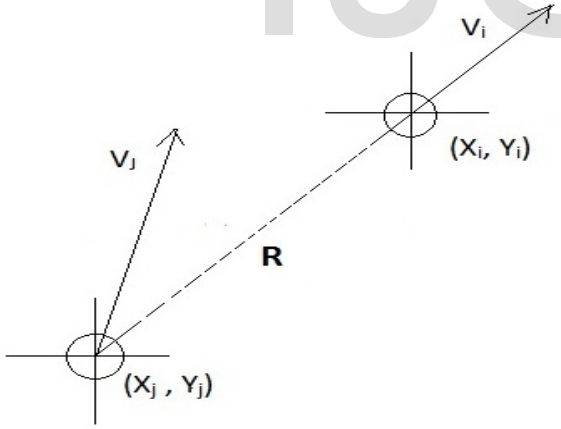

Fig- velocity vector for calculating LET

Vehicles are classified into four different directions based on changes in X, Y coordinates while movement figures. If the change in X, Y values are positive, then vehicle is considered to have direction 1 (0^0-90^0). If the change in X is negative and in Y is positive, then vehicle is considered to have direction 2 (90^0-180^0). If the change in X is negative and in Y is negative, then vehicle is considered to have direction 3(180^0-270^0). If the change in X is positive and in Y is negative, then vehicle is considered to have direction 4(270^0-360^0).

4.2 LET CALCULATION

With the help of GPS we can determine the duration of time these two nodes will remain connected [3]. Assume two nodes i and j are within the transmission range r of each other. Let (x_i, y_i) be the coordinate of vehicle host i and (x_j, y_j) be that of vehicle j. also let v_i and v_j be the speed and θ_i , θ_j $(0 < \theta i, \theta j < 2\pi)$ be the moving direction of vehicle i and j respectively . Then the amount of time that they will stay connected is predicted by

$$\text{LET} = \frac{-(ab + cd) + \sqrt{(a^2 + c^2)r^2 - (ad - bc)^2}}{a^2 + c^2}$$

Where

$a = v_i \cos\theta_i - v_j \cos\theta_j$

$b = x_i - x_j$

$c = v_i \sin\theta_i - v_j \sin\theta_j$

$d = y_i - y_j$.

4.3 ALGORITHM

1 The requesting vehicle broadcast an RREQ to all vehicle within range

2 When receiver vehicle get requested packet first it will checks that the current RREQ is already received (means duplicate packet) if it is than discard the packet if it is not than it will check whether it can provide the requested data or whether it has knowledge of a path that can provide this requested data if it does, it will produce an RREP, else it will add its own address to the request packet and rebroadcast the packet.

3 The RREP is reached at the source (requesting) vehicle, A vehicle can be selected as next in route between source and destination under two conditions:

- Intermediate node that moving in alongside with source and/or destination.

- Intermediate vehicle that have minimum difference between its speed and average speed and minimum hop count of source and destination Vehicle which moving toward the destination among multiple paths whose path will chosen whose stability is high.

4. And keep checking the validity of usable path and LET of path, based on GPS information because speed of vehicle is variable depend upon traffic and street light and road rules limit of speed and sudden stoppage , new route discovery is always initiated prior to the link being lapsed. This recurs at a time t before the estimated LET. And always keep searching for multiple paths to the destination and keep checking validity of path via hello message.

4.4 Linke Breakage

Because When the primary path breaks, the vehicle that first notice this breakage sends a RERR packet back to the source vehicle then selects the next best path that does not contain any link that was broken. The routing table is updated by removing all paths that contain broken link.

1. If there is a sudden broken link, the following scenario can be follows

- If there is an alternative path, at the vehicle which realizes the link broken, the alternative path is chosen, and a RERR packet containing the broken link information is sent back to the source vehicle. The data packet that are already on their way are sent via the new link (i.e. the packets are salvaged which is adapted from DSR packet salvaging [4]), where the original route cache in packet is replaced by the new alternative route cache and then forwarded hence the packet will not lost.

- At the worst case when algorithm fails means there is no suitable neighbor for sending the data, at that time recovery procedure will take place, for that store carry and forward mechanism will use[8][5].

5. Conclusion

In this paper work we proposed a routing algorithm for robust routing path. This algorithm provide robust path based on some parameter in spite of high mobility of the vehicles this mechanism will give high stable path for forwarding the packet. This protocol will give less end to end delay and high packet delivery ratio. This algorithm is using link expiration time mechanism for knowing the expiration time of the link, in that way sender node knows when link is going to expire before that it will create another path toward to destination so data will not lost and it will give maximum packet delivery ratio and less end to end delay, end to end delay will reduce because creating new path before the ongoing path (link) going to expire in that way it can reduce time and packet loss.

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