IPHV7I20046X
International Journal Of Advanced Research and Innovation -Vol.7, Issue .II
ISSN Online: 2319 – 9253
Print: 2319 – 9245

GREEDY ROUTING STRATEGY ON VANET NETWORK

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Abstract— In vehicular ad hoc networks as the nodes are highly mobile in nature, there is a chance for frequent link breakage. This will lead to frequent path discovery and data packet loss. The mobile nature of the nodes will decrease the performance of vehicular ad hoc networks. The overhead incurred for path discovery is not negligible. This will result in high routing overhead and less packet delivery ratio. In this paper, the work proposes a new protocol which exploits the neighbor node information with a rebroadcasting timer and rebroadcasting probability. The approach combines the merits of neighbor knowledge and probabilistic methodology. This will reduce the frequent transmission of route request and route reply. Whenever the link is broken the node will buffer the data packet till the link is re-established or new route is discovered. The network manager will set a timer value based on the rebroadcast delay value and will wait till the timer expires for the re-establishment of broken link; else it will forward the packet through new route with the calculated rebroadcast probability.

Keywords*: Destination discovery, greedy routing, unicast routing, vehicular ad hoc network (VANET).*

I.INTRODUCTION

The automotive industry is currently undergoing a phase of revolution. Today, a vehicle is not just a thermo mechanical machine with few electronic devices; rather, recent advancement in wireless communication technologies has brought a major transition of vehicles from a simple moving engine to an intelligent system carrier. A wide spectrum of novel safety and entertainment services are being driven by a new class of communications that are broadly classified as vehicle-to-vehicle communication and vehicle-to-infrastructure communication. Currently, intelligent transportation system components provide a wide range of services such as freeway management, crash prevention and safety, driver assistance, and infotainment of drivers and/or passengers. Recent trends swing toward advertisement, marketing, and business of services and products on wheels. Consequently, these applications appear to be very lucrative and promising in terms of commerce and research. The significant use of vehicular communications in safety and infotainment applications has resulted in the development of a new class of media access control and network layer protocols. The current domain of vehicular research includes routing, congestion control, collision avoidance, safety message broadcast, vehicular sensing, security, etc. Different terrains pose separate challenges to vehicular routing. The issues in a city network would not be exactly the same as in a highway or in a delay torrent network.

Vehicular ad hoc networks (VANETs) are infrastructure less networks where each node in the network is mobile in nature. These nodes will form a temporary network when they need to communicate with each other. In a VANET, the connectivity between nodes can change frequently, leading to the multi-hop communication that can allow communication without the use of base station or access point .The challenge exist in wireless network is in routing the data packets. Many routing protocols have been proposed and implemented for VANET.

The outskirts may have sparse vehicular density, whereas downtown has to deal with vehicular congestion. The evening may have the highest vehicular traffic, and midnight may be seen as the most silent period of the day. It is a most difficult job to predict the exact traffic density of a region. The structure of the road (i.e., straight or curved), number of intersections, number of lanes, length of the road (i.e., based on road ID), availability of public transport, and driver behavior have a great impact on the node density and network connectivity of a vehicular network. In a city network, intersections place a unique challenge to routing protocols. A routing protocol has to key on some parameters to decide the routing path. When the routing path is the shortest distance path, it may involve a very high number of changes of directions, resulting in higher hop counts. If the connectivity is chosen as the parameter, the most connected road segment would be overcrowded by frequently routing data packets through the same path. As a consequence, the data packets experience longer queuing delays. A third approach suggested in the literature involves broadcasting request messages to fetch the destination position information and connectivity information. However, in a city, flooding is not advisable as multiple nodes would probe for destination position and connectivity information. As a result, every blind search (i.e., flooding) would disrupt all the ongoing communications. In our approach, we choose hop count as the metric to find the routing paths. The hop greedy routing protocol exploits the transmission range and avoids intersections that are used to change the direction of the routing path. It is ensured that the selected intersections have enough connectivity. As the sender decides the routing path proactively, it is not possible to predict the actual connectivity value without probing the whole network. We adopt an indirect method to compute the connectivity parameter for each intersection. We found that connectivity increases with the increase in the number of lanes We therefore obtain the connectivity parameter based on the number of lanes. However, packet congestion will occur as the path with the highest connectivity may be used by multiple source–destination (src–dst) pairs. Hence, we specify a connectivity threshold, and paths having connectivity parameter beyond this threshold are assigned the same connectivity status. Apparently, the multi constrained optimal path finding problems are known to be NP-hard problems. Thus, we develop an approximation algorithm to choose a path based on both hop count and connectivity.

II. RELATED WORKS AND MOTIVATIONS

The VANET has witnessed several endeavors toward the development of suitable routing solutions. Originally, many routing protocols were solely designed for mobile ad hoc networks and later enhanced to suit the VANET scenarios .Later on, few novel protocols were developed for adverse VANET environments. Currently, researchers are working on a more concrete version of routing protocols with a higher performance index. However, noteworthy pioneering works such as greedy perimeter stateless routing (GPSR), greedy perimeter coordinator routing (GPCR) , geographic source routing (GSR)], vehicle assisted data delivery (VADD), anchor-based street- and traffic-aware routing (A-STAR), traffic (RBVT) [28], static-node-assisted adaptive data dissemination in vehicular networks (SADV) ,etc. have laid the foundation for routing in VANETs.The position-based routing protocol GPSR relies on the location service to acquire the position information of the destination. Basically, it uses two strategies, namely, greedy forwarding and perimeter routing, to send packets from source to destination. In greedy forwarding, a neighbor is chosen as the forwarding node if it has the shortest Euclidian distance to the destination among all neighbors. On the other hand, if no neighbor is witnessed closer to the destination than the sender itself, then perimeter routing is exercised. In GPCR, packets are forwarded by applying a restricted greedy forwarding procedure. During the selection of a forwarding node, a junction node termed as the coordinator node is preferred over a nonjunction node. Note that the coordinator node is not necessarily the closest node to the destination. However, the recovery strategy in GPCR remains the same as GPSR. The A-STAR features the best use of city bus route information to identify anchor paths. The main idea behind such arrangement is that more packets can be delivered to their destinations successfully using paths having more connectivity. Geographic source routing uses a static street map and location information about each node. The sender computes a sequence of intersections using Dijkstra’s shortest path algorithm to reach to the destination. The sequence of intersections is placed in the data packet header. The improved GyTAR is an intersection based geographical routing protocol that finds a sequence of intersections between source and destination considering parameters such as the remaining distance to the destination and the variation in vehicular traffic. The data forwarding between the intersections in GyTAR adopts either an improved greedy forwarding mechanism or a carry-and-forward mechanism, depending upon the availability of the forwarding node. In CAR, the source broadcasts request messages to probe the destination. The request message caches the change of direction information (i.e., change of forwarding angle above certain degree) and gathers the connectivity and hop count information en route. On receiving request message, the destination decides the routing path and replies to the source. Then, the data packets are forwarded along the path, as suggested by the destination. Additionally, the standing and moving guards take care of the position updates. In the following sections, we will discuss various issues and challenges faced by different VANET routing protocols. From the current research trends and comparisons, it is evident that position-based routing protocols are more suitable for city environments connectivity-aware routing (CAR) , greedy traffic-aware routing (GyTAR) , road-based using vehicular than other routing protocols. Routing protocols like GPSR, GPCR, GSR, A-STAR, and GyTAR work well in city environments. However, these protocols encounter different problems that motivate us to design a new robust scheme. Here, we discuss those problems and the corresponding motivations.

III.EXISTING WORK

In VANETs the route discovery is done by broadcasting the route request packets to the network, this will affect the QoS. It goes in hand with routing overhead, packet delivery ratio, MAC collision rate, and average end-to-end delay. The existing protocol tries to optimize these metrics and to improve the performance of network. The frequent broadcasting of route request will induce congestion in the networks. In DSRC [12] exchange of beacons are done for updating the positions. Routing in Ad hoc scenario can be small scale routing or large scale routing. The small scale routing is again classified into sender oriented and receiver oriented routing algorithms. V-TRADE (Vector-based Tracking Detection) algorithm is a sender oriented algorithm where it piggybacks the identity of the neighbor in the data packet. DDT (Distance Differ Time) is a receiver oriented algorithm, uses the next hop selection strategy. The transmitted vehicles append its location with the message. BPAB(Bin Partitioning Assisted Broadcasting) algorithm reduces the delay of emergency messages.CAR (Connectivity Aware Routing) is a large scale routing protocol where, more frequent beacons used when fewer neighbors are reported.

Back Bone Assisted Hope Greedy (BAHG) Routing is used for city environments [9]. Routing path is selected with minimal number of intermediate node considering connectivity. The protocol will track the movement of source and destination. Back-Bones are used to maintain the connectivity. Three backbone nodes are considered, stable, primary, secondary. When a node needs a new node to forward the packets it will consider these backbone nodes prior to other nodes.

A junction based multipath source routing (JMSR) [11] finds multiple path towards destination. It is having a junction centric logic. It maintains two paths to destination and route information injected into the packets. Here junctions' positions are having more importance than node positions. The injected information contains information about junctions a packet should visit.

The OLSR (Optical Link State Routing) [7] routing algorithm is furnished to suite for VANET scenario. It is a proactive routing algorithm. Status of each link is known immediately. The operation is simple, but it has to maintain a route table. OLSR is capable of managing multiple interface address of same host.

Shortest path based traffic light aware routing (STAR) is an intersection based routing for urban environment [5]. The traffic light determines how packets are forwarded. Each vehicle is equipped with GPS (Global positioning System) and digital map. Each vehicle moves smoothly when green light is ON. And those vehicles clusters when a red signal is ON. So when red signal is ON high chance for disconnection is there and can also cause additional delay. Vehicles reaching intersection will broadcast connectivity information. A new scalable hybrid routing protocol has been worked out for VANET scenario. It combines the advantages of re-active routing protocols and location based geographic routing protocols. Here the AODV is modified [8]. The route discovery is done in an on demand fashion.

IV.BACK-BONE-ASSISTED HOP GREEDY IN CITY VEHICULAR AD HOC NETWORKS

In this section, we present a position-based connectivity aware back-bone-assisted hop greedy (BAHG) routing protocol for VANET's city environments. The proposed routing protocol finds a routing path consisting of the minimum of intermediate intersections. The protocol is designed considering certain features in a city map, such as road segments, intersections, etc. To maintain connectivity at the intersections and to detect void regions, we rely on a group of nodes called back-bone nodes. Basically, we adopt a request-reply scheme to obtain destination position, which is then used to compute the routing path. To avoid the impact of mobility on routing decisions, an update procedure is specifically designed to supervise the movement of source as well as destination. Overall, the objective of the hop greedy routing algorithm is to reduce the hop count, which ultimately reduces the end-to-end delay. In addition, the protocol also ensures successful delivery of data packets to the destinations.

V. PERFORMANCE EVALUATION

In this section, we evaluate the performance of the BAHG protocol using an ns-2.31 simulator .BAHG is compared with routing protocols, namely, GPCR and GyTAR. Acity scenario with obstacles is considered to demonstrate the protocol performance.

A. Simulation Environment

We used the open- source microscopic mobility simulator SUMO to generate vehicle movements. Vehicles belong to one of seven vehicle types, where each type is represented by a certain maximum velocity (ranges from 5 to 35 m/s in steps of 5 m/s). A total of 600 vehicles are generated by the SUMO simulator. Once generated, they start moving along the specified routes while taking turns at the intersections. We considered ten randomly selected src–dst pairs that begin to communicate at different time instants and remain active until the end of the simulation. Simulation is conducted for multiple scenarios represented by different vehicular movements, and the outcomes are averaged to obtain the performance graphs. To implement the obstacle model, we specify an attenuation of 5 dB. This value is added to the received power of a packet arrived through a nonline-of-sight path. By the use of digital road map, vehicles can determine whether the sender of the packet is located on a nonline-of-sight path. The protocols GPCR and GYTAR are implemented.

B. Routing Metrics

1) Packet delivery ratio (%): This is the ratio of the total number of packets received at the destination to the total number of packets generated by the source. 2) End-to-end delay: This is the delay elapsed between packet generation at the source and successful reception at the destination.

C. Simulation Results and Analysis

In this section, the packet delivery ratio and end-to-end delay of all three protocols are investigated with respect to certain factors such as initial src–dst distance, destination dislocation distance, and packet sending rate. In the simulations, the initial src–dst distance implies the distance between the source and the destination when the source generates the first packet. The second factor destination dislocation distance refers to the distance traveled by the destination during the entire communication period. Finally, the packet sending rate refers to the number of packets generated by the source per second.

VI.CONCLUSION

In this work, the proposed algorithm aims to improve the routing efficiency of VANET .Whenever a route fails it won't suddenly broadcast route request; it will wait till timer expires. At that time the node will buffer the packets. If route is re-established within timer it will send the packets through same link, else it will re-broadcast the route request. The calculation of re-broadcasting probability and rebroadcasting timer helps to improve the performance of the network by reducing the routing overhead. The zone wise partitioning of a city road network is an important design framework for the efficient functioning of the destination discovery procedure. The hop greedy algorithm finds the best possible path in terms of both hop count and connectivity. To address connectivity issues such as void regions and unavailability of forwarders, the concept of back-bone node is introduced. Moreover, by employing unicast request messages, the proposed routing scheme eliminates packet loss and congestion noticed in contemporary routing protocols that use broadcast request messages. We also propose an update procedure that is very effective to deal with destination movements. The simulation results confirmed that the packet generation rate, the distance between the source and the destination, and the distance of destination movement do not have a large impact on the performance of the proposed scheme, which outperforms GPCR and GyTAR in terms of packet delivery ratio and end-to-end delay.

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