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A SURVEY ON TRAFFIC AWARE ROUTING PROTOCOL IN VEHICULAR AD-HOC NETWORKS

[1]Asst. Prof. Jyoti R Maranur, [2]Basavaraj Mathapati

Computer Science and Engineering, Godutai Engineering College for Women, Kalaburagi, India

Computer Science and Engineering, Appa, Institute of Engineering and Technology, Kalaburagi, India

Abstract: **Vehicular ad hoc network (VANET) is a type of mobile ad hoc network (MANET) that forms vehicles as nodes. Routing is the basic fundamental requirement of VANET applications. Therefore, it is necessary to devise a routing protocol that fits well for rapid topology changes and disconnected network conditions. To address these specific needs of VANET, we present a novel greedy routing protocol for vehicular networks called VRPTA that suite well for both city environment and the high way environment. With the help of localisation system named global positioning system (GPS), the proposed protocol is designed to efficiently relay the data in the network by considering different scenarios like road traffic variation and various environment characteristics. The protocol communicates in between vehicles as well as vehicle to infrastructure whichever is applicable, thereby ensuring reliable transmission. In addition, we also consider the information about vehicles speed, direction and density of a city traffic configuration consisting of double direction roads, multi lanes and highway scenario. The work is implemented using NS2 simulator.**

Keywords: **Vehicular ad hoc network (VANET), global positioning system (GPS), protocol communicates.**

1. INTRODUCTION

Vehicular ad-hoc networks are considered as a particular class of mobile ad-hoc networks (MANETs) built on moving vehicles. This kind of networks is characterized by high node mobility in limited degree of freedom and unreliable wireless channel conditions. On the other hand, nodes in these networks have sufficient energy resources and processing power to perform more complicated networking protocols. Such particular features often make standards and common MANET protocols sub-optimal for VANETs. Because of high vehicle mobility, the network topology and nodes' connectivity are continuously changing over time. The routing protocol is responsible to handle such topology changes while routing data packets. There are certain Quality-of-Service (QoS) requirements in every VANET application that should be satisfied by the routing algorithm. End-to-end latency and packet delivery ratio (PDR) are common QoS requirement.

VANET routing protocols are classified into topology-based and position-based classes. In topology-based approaches the next forwarding node is selected based on the network topology information. Location-based or geographical routing protocols are based on geographical information of the nodes. By knowing the location of the destination and the nodes in the network, forwarding nodes can be selected to route the packet from the source node to the desired destination(s). Application-level QoS demands, and the features of the hardware platform (e.g., communication and computation capabilities and peripheral equipment) should be taken into consideration for designing an appropriate routing technique for such multi-hop data propagation. In this paper, we focus on geographic routing in city environments. As it is common in VANETs, we take into account the use of Global Positioning System (GPS) devices so that every vehicle is aware of its own location and movement parameters such as velocity and direction. We propose TIGeR, a new Traffic-aware Intersection-based Geographical Routing protocol[1]. It uses an angular-based mechanism taking the local traffic information at intersections into account to select reliable routes toward the destination.

2. THE VRPTA PROTOCOL

Our VANET routing protocol with traffic aware approach (VRPTA)[2] is a geographical routing protocol, efficient to accomplish robust routes, provides optimal performance in city scenarios as well as in highways. To achieve this goal, it utilises GPS to identify its own position. It also uses grid location service (GLS) to learn the position of destination vehicle. Every vehicle contains onboard navigation system that acquires the knowledge of neighbouring road segments and also gives updated city's street information with the help of preloaded digital maps. The proposed protocol contains three vital components viz., RSU placement strategy, route selection mechanism and routing.

RSU placement strategy Our system includes road side units installed at necessary points in the highway scenario and in urban environment. The RSUs transmit warning messages and traffic statistics to vehicles and the other RSUs. The RSUs are placed at the intersection of roads in urban environment.

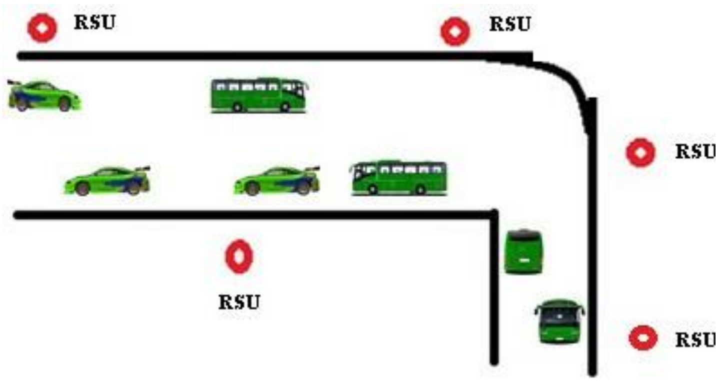

Figure 1 Highway scenario

Various factors to be considered while deploying RSUs in the highway are city borders, intersections, accident prone regions collected from the map, nearest U-turns and changing lanes:

1 RSU can be placed just before the accident prone regions where, even when V2V is not possible, the vehicles can be alerted by these RSUs. This can help the vehicles to control their speed and be cautious.

2 A few km behind the city borders – because in the borders there will be a probability of vehicles that are moving into the city or coming out of city. So instead of placing at the region borders, installing RSU behind them will be more fruitful. The RSUs at these places will give additional information like next nearest fuel station, nearest U-turns and sharp bends.

3 Uniformly distributing the RSUs with equal interval in case of the usual straight stretching lanes.

The route selection mechanism VRPTA dynamically chooses the next road segments along which a packet should pass to reach its destination considering the real time vehicular traffic variation. Like all other position-based source routing protocols, the proposed protocol selects the road segment-based routing approach with street awareness. Therefore, data packets will be routed between vehicles, following the street map topology. Unlike some position-based protocols that do not consider the vehicle speed, our protocol takes into account the velocity for link stability. The movement prediction-based routing (MOPR) concept (Menouar et al., 2007) stipulated that a vehicle velocity can be used for a precise estimate of link stability. So employing MOPR in our protocol guides every vehicle to assess communication link stability before choosing next hop for sending data among other vehicles nearby. At first, the link lifetime will be denoted in terms of the total estimation time then, by dividing the estimated communication lifetime with the route validity time, that is a constant; the link stability will be the outcome. Once LS is calculated for each neighbouring vehicle, MOPR [3] selects the next hop for data forwarding/sending, the node corresponding to the highest LS. Hence, it is ensured that a vehicle that is out of the effective communication range is not chosen as the next hop for sending/forwarding data. Also, the retransmission overhead in every node of the network will be minimised significantly.

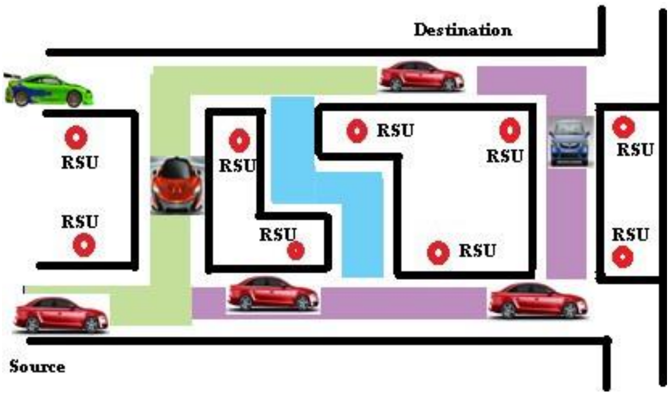

Figure 2 City environment (see online version for colours)

Assume source vehicle needs to send a packet to destination that has three options: G, B and L. It is critical to choose the road segment that has shorter curve metric distance, higher LS and reasonable traffic density. The segment G is chosen as next segment which has minimum curve metric distance, maximum link stability value and minimum traffic density when compared to other two routes.

G green colour shaded road segment B blue colour shaded road segment

L lavender colour shaded road segment.

Data forwarding When the next road segment is calculated, the improved greedy algorithm is employed for data forwarding, periodically every vehicle broadcasts beacon messages to its neighbours. Beacons contains the information like speed of the vehicle, vehicle's type (priority or not), direction and position. So every vehicle generates its own neighbouring table based on the beacon information. Next, link stability (LS) for every neighbouring vehicle is computed, MOPR chooses the node that have greatest LS as a next hop for data forwarding/sending. The relationship between the link communication lifetime (LifeTime[i,j]) and a constant value(s) is called as LS. LifeTime[i, j]LinkstabilityLS[i, j] , with LS[i, j] 1 when LifeTime[i, j] σ σ t

where σ indicates routing route validity time and LifeTime[i, j] indicates lifetime of the link (i, j). Hence, in this protocol, it is possible for the sender/forwarder vehicle to predict the co-vehicles topology, position and the stable nodes for next few seconds, then chooses the next nearest hop to the destination,. If sender is the nearest vehicle to the next segment, it must carry the data until it reaches that segment. So on receiving a packet, actions are taken according to the strategy below. On receiving the message, the receiving vehicle checks for the vehicle type. When the sender vehicle is an ambulance, then such vehicle's type is set as high priority (type = HP) in the beacon message. Such vehicles will be given path by the receiver vehicles, via reducing their velocity and changing position. When any accident or road blockage occurs, then the nearest RSUs will transmit the warning messages to the RSUs behind and the vehicles behind. In such cases, the messages are transmitted behind.

3. LITERATURE SURVEY

One of the first geographical routing protocols for mobile environments is GPSR [3]. It works in two modes. 1) Greedy forwarding mode in which packets are forwarded to the nodes that are geographically closer to the destination. If there is not any node closer to the destination, the greedy forwarding may come to a deadlock. In such condition, the forwarding node switches to the second mode. 2) Perimeter mode in which the node forwards the packet to one of its neighbors based on the right-hand rule. The forwarding node continues in perimeter mode until it finds a neighbor that is closer to the destination.

Abedi et al. (2008, 2009) introduced the conventional MANET routing protocol, AODV[4] to PAODV and DAODV is used to improve the route stability with very less network overhead so that it helps to make it appropriate for VANET, and they also conclude by predicting the exact routes with and without using mobility prediction. Since topology undergoes drastic and frequent changes in VANETs, the topology-based routing protocols cannot be fitted to the VANETs. Besides these, several position-based routing protocols have been proposed and the comparison between position-based routing and topology-based is done in Royer and Toh (1999) and Broch et al. (1998). It is clear that the position-based routing is better than topology-based routing in highly mobile environment like VANET. The position-based routing protocol provide high delivery ratio than topology-based routing protocol. Liu et al. (2004) proposed anchor-based street and traffic aware routing (A-STAR)[5] for city environment; it is novel position-based routing protocol that applies a more efficient recovery strategy for local maxima problem. New anchor paths are computed by A-STAR for recovery and it also declares the void area causing local maxima problem temporarily unavailable. A-STAR provides better performance as compared to GSR and GPCR.

Some mechanisms use nodes at intersections and street topology to make better routing decisions. For instance, GPCR exploits an intersection detection mechanism using information of one- and two-hop neighbors. This information is obtained by periodically exchanging messages between neighboring nodes which imposes a high communication overhead. Geographic source routing (GSR) is an intersection-based protocol in which the sender uses Djikstra shortest path algorithm to determine a sequence of intersections that a packet needs to traverse toward its destination by using the street map. This information is then included in the packet header to be used by all forwarding nodes in the path. Vehicle assisted data delivery protocol (VADD) also uses street map. This protocol uses a store-and-forward technique at intersections to select the roads with the lowest estimated delay to the destination. In static-node assisted data dissemination protocol (SADV) [6], some static nodes at intersections are used to improve data delivery. When there is no vehicle available to forward a packet, the nearest static node stores the packet until a proper delivery path is available. A multi-path routing mechanism is also exploited in SADV to reduce data delivery delay at the cost of higher communication overhead.

None of the mentioned protocols takes the vehicular traffic information into account for making routing decisions. Therefore, they may lead to routing loops. The Greedy Traffic-aware Routing protocol (GyTAR)[7] takes the roads vehicular traffic into account to select the most reliable route. When a packet reaches a node at an intersection, the node selects an adjacent intersection toward the destination with the highest vehicular traffic, hoping that it provides better wireless connectivity. This leads to performance improvement comparing to other routing approaches. However, it uses a decentralized cellular traffic density estimation method which imposes high network traffic overhead. Moreover, routing may fail when no digital map is available.

4. CONCLUSION

a vehicular hybrid routing protocol with traffic aware approach (VRPTA) that uses real time traffic density information to route data and MOPR concept for link stability in VANETs. The routing protocol first finds the optimal route, and then forwards the packets to the destination. We have optimally placed RSUs in both urban and highway environment.

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