

Geographical Based Routing Protocols in VANET Architecture

Amita Jaiswal¹, Arun Kumar Shukla²

¹Teaching Associate, Department of Computer Science & I.T., The Shepherd School of Engineering & Technology, SHIATS, Allahabad 211007, U.P, India.

²Assistant Professor, Department of Computer Science & I.T., The Shepherd School of Engineering & Technology, SHIATS, Allahabad 211007, U.P, India.

Abstract: VANET is the core of Intelligent Transportation Systems where the vehicles are able to communicate with each other through beacon messages to make aware of the traffic problems, any other road accidents, assistance to the driver, new updates from stores and malls, etc. The VANET architecture comprises of Vehicle to Vehicle Communication (V2V), Vehicle to Infrastructure Communication (V2I), Vehicle to Roadside Communication (V2R). Each communication two different environments i.e., City Environment and Highway Environment. Now these two environments have different types of traffic problems due to which the vehicle density is sometimes sparse and sometimes dense. In this paper, geographical based VANET routing protocols have been discussed and we have tried to find out which routing protocol will be more suitable in the VANET architecture. As the previous works shows that the protocols which are used in VANET are the MANET protocols for routing information. But since VANET is different from MANET in several ways, so there is a need to develop protocols which are purely based on VANET architecture. Finally, we have described some geographical based routing protocols which can be used in VANET.

Keywords: VANET, MANET, VANET architecture.

1. Introduction

A vehicular ad hoc network (VANET) uses cars as mobile nodes in a MANET to create a mobile network.[1] A VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 metres of each other to connect and, in turn, create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile Internet is created. It is estimated that the first systems that will integrate this technology are police and fire vehicles to communicate with each other for safety purposes.

Automotive companies like General Motors, Toyota, Nissan, DaimlerChrysler, BMW and Ford promote this term. Most of the concerns of interest to mobile ad hoc networks (MANETs) are of interest in VANETs, but the details differ. Rather than moving at random, vehicles tend to move in an organized fashion. The interactions with roadside equipment can likewise be characterized fairly accurately. And finally, most vehicles are restricted in their range of motion, for example by being constrained to follow a paved highway.

2. Related Work

Previous work done represents many protocols which are geographical in nature. A class of routing protocols for vehicular ad hoc networks (VANETs) called the Intersection-based Geographical Routing Protocol (IGRP), which outperforms existing routing schemes in city environments. IGRP is based on an effective selection of road intersections through which a packet must pass to reach the gateway to the Internet. The selection is made in a way that guarantees, with high probability, network connectivity among the road intersections while satisfying quality-of-service (QoS) constraints on tolerable delay, bandwidth

usage, and error rate. Geographical forwarding is used to transfer packets between any two intersections on the path, reducing the path's sensitivity to individual node movements.

Multihop data delivery between vehicles is an important aspect for the support of VANET-based applications. Although data dissemination and routing have extensively been addressed, many unique characteristics of VANETs, together with the diversity in promising applications, offer newer research challenges. The improved greedy traffic-aware routing protocol (GyTAR), which is an intersection-based geographical routing protocol that is capable of finding robust and optimal routes within urban environments. The main principle behind GyTAR is the dynamic and in-sequence selection of intersections through which data packets are forwarded to the destinations. The intersections are chosen considering parameters such as the remaining distance to the destination and the variation in vehicular traffic. Data forwarding between intersections in GyTAR adopts an improved greedy carry-and-forward mechanism. Evaluation of the proposed routing protocol shows significant performance improvement in comparison with other existing routing approaches. With the aid of extensive simulations, we also validate the optimality and sensitivity of significant GyTAR parameters.

Vehicular ad hoc network (VANET) is an emerging new technology integrating ad hoc network, wireless LAN (WLAN) and cellular technology to achieve intelligent inter-vehicle communications and improve road traffic safety and efficiency. VANETs are distinguished from other kinds of ad hoc networks by their hybrid network architectures, node movement characteristics, and new application scenarios. Therefore, VANETs pose many unique networking research challenges, and the design of an efficient routing protocol for VANETs is very crucial. In this article, we discuss the

research challenge of routing in VANETs and survey recent routing protocols and related mobility models for VANETs.[3]

The concept of anchor-based routing in sensor networks has been adapted to VANET environments. GSR and SAR integrate the road topologies in routing using those concepts. In these protocols, a source computes the shortest road-based path from its current position to the destination.

Similar to RBVT, they include the list of intersections that define the path from the source to the destination in the header of each data packet that was sent by the source. However, they do not consider the real-time vehicular traffic, and consequently, they could include empty roads. To alleviate this issue, A-STAR modifies GSR by giving preference to streets served by transit buses each time a new intersection will be added to the source route. CAR finds connected paths between source-destination pairs, considering vehicular traffic, and uses “guards” to adapt to movements of nodes.

3. Conclusion

The VANET which is an essential technology in the ITS has some disadvantages such as short time for link connection and high packet loss ratio. Therefore, routing protocols that provide stable routes are required. In order to evaluate the performance of the RVDVR routing mechanism, it is being compared with GPSR through QualNet 5.0 based simulations and showed that RVDVR outperforms GPSR in terms of delivery success rate and routing overhead. With QualNet there are various advantages over other simulation platforms like easy-to-use and clear user interface, support for distributed computing, sophisticated animation capabilities, extensive possibilities for analyzing scenario, shipped with a lot helpful documentation and tons of example scenarios. Finally, it has been realised that on the basis of VANET architecture and environment, protocols should be more powerful to deal with problems related to traffic etc.

From a networking point of view, in terms of vehicles and speed distribution, queuing dynamics and presence and size of clusters may heavily affect the connectivity of VANET architecture and consequently, the performance of ad-hoc network protocols. It is a part of future work to investigate the actual impact of these traffic generating conditions on a vehicular network, so as to understand which factors must be considered and which can be neglected for a confident VANETs simulation study.

GPS and navigation systems might benefit,[2] as they could be integrated with traffic reports to provide the fastest route to work. It was also promoted for free, VoIP services such as Google Talk or Skype between employees, lowering telecommunications costs.

Intelligent vehicular ad-hoc network (InVANET) is another term for promoting vehicular networking. InVANET integrates multiple networking technologies such as Wi-Fi IEEE 802.11p, WAVE IEEE 1609, WiMAX IEEE 802.16, Bluetooth, IRA and ZigBee.

Vehicular ad hoc networks are expected to implement wireless technologies such as dedicated short-range communications (DSRC) which is a type of Wi-Fi. Other candidate wireless technologies are cellular, satellite, and WiMAX. Vehicular ad hoc networks can be viewed as component of the intelligent transportation systems (ITS).

As promoted in ITS, vehicles communicate with each other via inter-vehicle communication (IVC) as well as with roadside base stations via roadside-to-vehicle communication (RVC). Within the IEEE Communications Society, there is a Technical Subcommittee on Vehicular Networks & Telematics Applications (VNTA). The charter of this committee is to actively promote technical activities in the field of vehicular networks, V2V, V2R and V2I communications, standards, communications-enabled road and vehicle safety, real-time traffic monitoring, intersection management technologies, future telematics applications, and ITS-based services.



Figure1: VANET Architecture

One alternative approach is offered by geographical routing protocols, e.g., greedy-face-greedy (GFG) [4], greedy other adaptive face routing (GOAFR) [5], greedy perimeter stateless routing (GPSR) [6], which decouple forwarding from the nodes identity. These protocols do not establish routes but use the position of the destination and the position of the neighbor nodes to forward data. Unlike node-centric routing, geographical routing has the advantage that any node that ensures progress toward the destination can be used for forwarding. Despite better path stability, geographical forwarding does not also perform well in city-based VANETs [7]. Its problem is that, oftentimes, it cannot find a next hop (i.e., a node that is closer to the destination than the current node).

The recovery strategies in the literature are often based on planar graph traversals, which were shown to be ineffective in VANETs due to radio obstacles, high node mobility, and the fact that vehicle positions are constrained on roads rather than being uniformly distributed across a region. A number of road-based routing protocols have been designed to address this issue. However, several protocols fail to factor in the vehicular traffic flow by using the shortest road path between the source and the destination. As depicted in other projects try to alleviate this issue by using historical data about average daily/hourly vehicular traffic flows. Unfortunately, historical data are not accurate indicators of the current road traffic conditions, because events such as

road constructions or accidents that lead to traffic redirection are not rare.

Routing has been a major research topic in MANETs. AODV, DSDV, DSR, and OLSR are node-centric MANET protocols in which topological end-to-end paths are created. To improve on their performance in VANETs, solutions have been proposed, which exploit the knowledge of relative velocities between nodes and the constrained movements of vehicles. This information is used to select nodes with high relative velocity to the destination, predict the lifetime of routes, or reduce the number of route breaks by selecting, during the route creation, nodes that move in the same direction and with a small relative speed. RBVT routing differs from these protocols in that the routes are road based, and their main components are the road intersections that were traversed on the path from the source to the destination. Geographical routing protocols, e.g., GPSR, GFG, and GOAFR, use node positions to route data between endpoints. When a local maxima is reached (i.e., a position where progress cannot be made based on node positions), recovery strategies are proposed to route the packets around the void. Solutions and propose to improve recovery strategies in VANETs by either proactively detecting potential dead-end positions or using channel overhearing capabilities of wireless networks to

References

- [1] "A Comparative study of MANET and VANET Environment". *Journal of Computing* 2 (7). July 2010. Retrieved 28 October 2013
- [2] "Obstacle Management in VANET using Game Theory and Fuzzy Logic Control". *International Journal on Communication* 4 (1). June 2013. Retrieved 30 August 2013
- [3] *Vehicular Technology Magazine, IEEE (Volume:2 , Issue: 2)*
- [4] P. Bose, P. Morin, I. Stojmenovic, and J. Urrutia, "Routing with guaranteed delivery in ad hoc wireless networks," *ACM Wirel. Netw.*, vol. 7, no. 6, pp. 609–616, Nov. 2001.
- [5] F. Kuhn, R. Wattenhofer, Y. Zhang, and A. Zollinger, "Geometric ad hoc routing: Of theory and practice," in *Proc. 22nd Annu. Symp. Principles Distrib. Comput.*, Boston, MA, Jul. 2003, pp. 63–72.
- [6] B. Karp and H. T. Kung, "GPSR: Greedy perimeter stateless routing for wireless networks," in *Proc. 6th Annu. Int. MobiCom*, Boston, MA, Aug. 2000, pp. 243–254.
- [7] T. Li, S. K. Hazra, and W. Seah, "A position-based routing protocol for metropolitan bus networks," in *Proc. 61st IEEE VTC—Spring*, Stockholm, Sweden, Jun. 2005, pp. 2315–2319.