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Review

A Review of Vehicle to Vehicle Communication Protocols for VANETs in the Urban Environment

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Abstract: Vehicular Ad-hoc Networks (VANETs) have been gaining significant attention from the research community due to their increasing importance for building an intelligent transportation system. The characteristics of VANETs, such as high mobility, network partitioning, intermittent connectivity and obstacles in city environments, make routing a challenging task. Due to these characteristics of VANETs, the performance of a routing protocol is degraded. The position-based routing is considered to be the most significant approach in VANETs. In this paper, we present a brief review of most significant position based unicast routing protocols designed for vehicle to vehicle communications in the urban environment. We provide them with their working features for exchanging information between vehicular nodes. We describe their pros and cons. This study also provides a comparison of the vehicle to vehicle communication based routing protocols. The comparative study is based on some significant factors such as mobility, traffic density, forwarding techniques and method of junction selection mechanism, and strategy used to handle a local optimum situation. It also provides the simulation based study of existing dynamic junction selection routing protocols and a static junction selection routing protocol. It provides a profound insight into the routing techniques suggested in this area and the most valuable solutions to advance VANETs. More importantly, it can be used as a source of references to other researchers in finding literature that is relevant to routing in VANETs.

Keywords: position; routing; VANETs; urban scenario; protocols; traffic density

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Adnan Shahid Khan is currently a senior lecturer at Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak. He has completed his Postdoctoral, Ph.D. and Masters in Networks in 2013, 2012, 2008 respectively from Universiti Technology Malaysia, Johor Bahru, Malaysia and BSc (Hons) Computer Sciences in 2005 from University of Punjab, Lahore Pakistan. His research interest includes Network and Network Security in Wireless communication. He has published more than 70 papers in peer reviewed conferences and journals. He is also acting as a reviewer of many journals.

1. Introduction

The vehicular ad-hoc network (VANET) is also called network on wheels, which is used to provide communication between vehicular nodes. It is an offshoot of mobile ad-hoc networks. In VANETs, vehicular nodes are self-organized and communicate with each other in an infrastructureless environment [1–7]. Knowing the importance of vehicular ad-hoc network for providing safety-related applications in Intelligent Transportation System (ITS), the IEEE committee has developed the IEEE 802.11p standard for VANETs [1]. The US Federal Communication Commission (FFC) department has assigned 75 MHz of bandwidth at 5.9 GHz for dedicated short-range communication (DSRC), which is used to provide communications between vehicle to vehicle and vehicle to infrastructure [1]. The main aim of VANETs is to build an intelligent transportation system. DSRC can play an important role in building communications between vehicle to vehicle (V2V) and vehicle to infrastructure (V2I). The range of DSRC is about one thousand meters [8].

From the last few years, inter-networking over VANETs has been achieving massive momentum. Realizing its intensifying significance, academia, major car manufacturers, and governmental institutes are making efforts to develop VANETs. Various significant projects are initiated by different countries and famous industrial firms such as Daimler-Chrysler, Toyota, and BMW for inter-vehicular communications. Some of these prominent projects include CarTALK2000 [9], Car-to-Car Communication Consortium (C2CCC) [10], Advanced Driver Assistance Systems (ADASE2), California Partners for Advanced Transit and Highways (California PATH) [11], FleetNet [12], DEMO 2000 by Japan Automobile Research Institute (JSK) [12], Chauffeur in EU [13], and Crash Avoidance Metrics Partnership (CAMP) [14]. These developments are a key step toward the recognition of intelligent transportation services.