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A Reliable Path Selection and Packet Forwarding Routing Protocol for Vehicular Ad hoc Networks

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Abstract

Vehicular ad hoc networks (VANETs) have earned a gigantic consideration in the recent era. Wide deployment of VANETs for enhancing traffic safety, traffic management, and assisting drivers through elegant transportation system is facing several research challenges that need to be addressed. One of the crucial issues consists of the design of scalable routing algorithms that are robust to rapid topology changes and frequent link disconnections caused by the high mobility of vehicles. In this article, first of all, we give a detailed technical analysis, comparison, and drawbacks of the existing state-of-the-art routing protocols. Then, we propose a novel routing scheme called a Reliable Path Selection and Packet Forwarding Routing Protocol (RPSPF). The novelty of our protocol comes from the fact that firstly it establishes an optimal route for vehicles to send packets towards their respective destinations by considering connectivity and the shortest optimal distance based on multiple intersections. Secondly, it uses a novel reliable packet forwarding technique in-between intersections that avoids packet loss while forwarding packet due to the occurrence of sudden link ruptures. The performance of the protocol is assessed through computer simulations. Simulation outcomes specify the gains of the proposed routing scheme as compared to the earlier significant protocols like GSR (Geographic Source Routing), GPSR (Greedy Perimeter Stateless Routing), E-GyTAR (Enhanced Greedy Traffic Aware Routing), and TFOR (Traffic Flow-Oriented Routing) in terms of routing metrics such as delivery ratio, end-to-end delay, and routing overhead.

Keywords: Multiple intersections, Position-based routing, Optimal route, Forwarding

1 Introduction

The immense growth of automobiles and irregular behavior of drivers on the road cause traffic congestion, accidents, wastage of fuel, and loss of precious lives, which makes the existing transportation system inefficient. To direct these challenges, a new research field called as Intelligent Transportation System (ITS) has been proposed. It applies a combination of multiple promising technologies of automobiles and transportation system in order to enhance security, safety, effectiveness of transportation systems, vehicle control, and provision of latest mobile services and applications to the on-road public by advancing traffic management system. In ITS, developing vehicle to vehicle and vehicle to infrastructure communication is an outstanding challenge to ITS industry. Thus, the US Federal Communication Commission has approved 75-MHz spectrum at 5.9 GHz for dedicated short-range communications (DSRC) [1–3] for the successful deployments of WLAN technologies for making vehicular ad hoc networks (VANETs) a reality.

From the last few years, inter-networking over VANETs has been achieving a massive momentum. Realizing its intensifying significance, the academic research society, 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 [4], Car-to-Car Communication ConsortiumC2CCC [5], Advanced Driver Assistance Systems (ADASE2), California Partners for Advanced Transit and Highways (California PATH) [6], FleetNet [7], DEMO 2000 by Japan Automobile Research

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