

A Hybrid Network System Based on Smartphone for VANETs

Sangsoo Jeong^{*} Youngmi Baek[†] Sang H. Son^{*}

^{*} Department of Information and Communication Engineering
DGIST, Daegu, Republic of Korea
E-mail: {88jeongss, son}@dgist.ac.kr

[†]CPS Global Center, DGIST, Daegu, Republic of Korea
DGIST, Daegu, Republic of Korea
E-mail: ymbaek@dgist.ac.kr

Abstract

Vehicular Ad-hoc Networks (VANETs) using a connected-car technology can support various applications in Cooperative Intelligent Transportation Systems (C-ITS). While WAVE/DSRC has been investigated by a number of researchers to support VANETs, it may not be easy to distribute WAVE/DSRC in the near future due to several practical obstacles. In this paper, we discuss an alternative to support V2X communication without using WAVE/DSRC. Therefore, we propose a novel hybrid system which incorporates a flexible mix of a cellular network and Wi-Fi Direct. Especially, to offload cellular traffic and alleviate additional cost, Wi-Fi Direct is used as a subsidiary method to enable communication by using local links without the help of infrastructure. We hope that our work catalyzes introducing vehicular applications.

Keywords: smartphone, VANETs, Wi-Fi.

1. Introduction

Cooperative Intelligent Transportation System (C-ITS) uses wireless technologies that enable vehicles to communicate with other vehicles as well as with infrastructure in order to improve road safety, traffic efficiency, and fuel efficiency. There are quite a number of different types of applications based on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication. Although it is possible to implement these applications without the help of vehicle-to-everything (V2X) communication, V2X significantly improves the performance of these systems [1], [2], [3]. For example, vehicle platooning is possible by only utilizing adaptive cruise control (ACC) which does not use V2X for calculating inter-vehicle distance. If all vehicles form cooperative adaptive cruise control (CACC) based platoon, traffic flow (vehicles per hour) on the road can be increased approximately more than 2.5 times higher [4]. This is one example to illustrate the importance of wireless communications for the advanced performance of C-ITS. However, it is expected that deployment of DSRC (Dedicated Short Range Communication), which is currently standardized for the V2X communication, requires several decades. Therefore, new attempts at the V2X communication have created the integration of various wireless communication technologies without using expensive infrastructure. Some of them are interested in utilizing a smartphone to implement DSRC/WAVE-based solutions by focusing on high smartphone penetration rate [5]. It provides more convenient and safer driving conditions on the road at overall lower costs.

