Chapter 9
Development of Applications for Vehicular Communication Network Environments: Challenges and Opportunities

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ABSTRACT

Nowadays, modern society faces serious problems with transportation systems. There are more traffic jams, accidents, and fatalities, and CO2 emissions are increasing fast. Thus, improving the safety and efficiency of transportation systems is imperative. Developing a sustainable transportation system requires a better usage of the existing infrastructure, the adoption of emerging technologies (e.g. embedded devices, sensors, and short range radio transmitters), and the development of applications capable of operating in wireless and spontaneous networks. This chapter gives readers a global vision of the issues related to the development of applications for vehicular ad-hoc networks (VANET). It also presents a classification and an overview of the top-level application domain. In addition, it investigates the importance of information in vehicular networks and analyses the requirements for different types of vehicular applications. Finally, the communication schemes that underpin the operation of VANET applications, as well as the security threats they are exposed to, are studied.

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INTRODUCTION

Modern society is facing serious problems with the transportation systems. In the last years the levels of traffic congestion, fatalities, accidents and pollution have increased significantly. To improve the safety, security and efficiency of the transportation systems and enable the development of novel vehicular applications Intelligent Transportation Systems (ITS) have been developed (Qian & Moayeri, 2008). These systems are characterized for utilizing communication and information technologies in vehicles and transportation infrastructures. Different countries or regions have defined their own vision and definition for ITS:

- **ERTICO – ITS Europe** defines ITS as the new application that information and communication technologies are finding in urban transport and it is also referred as “Transport Telematics” (ERTICO-a, 1998).
- **ITS America** defines ITS as a broad range of different technologies which hold the answer to many of the existing transportation problems. ITS is comprised of a number of technologies including information processing, communications, control, and electronics. With the integration of all these technologies into existing transportation systems, lives, time and money will be saved (America, 2009).
- **ITS Australia** defines ITS as a broad term which is used to describe developments in communication and computing technologies applied to transport services in general. (Australia, 2009).
- **ITS Japan** states that ITS offer a fundamental solution to various issues that concern to transportation systems, including traffic accidents, congestion and environmental pollution. ITS deals with these issues using the most advanced communication and control technologies (Japan, 2009).
- **ITS Canada** defines ITS as the application of advanced and emerging technologies (e.g. computers, sensors, control, communications and electronic devices) in transportation to save lives, time, money, energy and the environment. (Canada, 2009)

As read, different regions of the world share a same vision of ITS: the usage of emerging technologies to solve issues concerning to transportation systems. One of the most important components of ITS is the vehicular ad-hoc network (VANET). A VANET is an upcoming type of wireless ad-hoc network designed to provide support to a wide variety of applications with the aim of bringing modern society a series of benefits in areas such as vehicular safety, entertainment and traffic control among others.

Providing vehicles with relevant information about other vehicles or environmental data may improve the safety, efficiency and effectiveness of existing transportation systems. With the development of wireless and cellular networks several innovative vehicular applications for security, traffic control, and entertainment can be developed. Although some vehicular application requirements have already been investigated in the Mobile Ad-hoc Network (MANET) environment, there still exist important challenges to be studied for correctly exploiting vehicle and traffic information (e.g. the knowledge of the dynamics of a vehicle) to improve inter-vehicular communication. In this sense, several factors can influence the development and adoption of applications for vehicular networks and they must be considered for the successful development of applications. Some of these factors include: i) low latency requirements for different applications, ii) extensive growth of interactive and multimedia applications and iii) the emergence of different security and privacy concerns.