

# Chapter 14

## Challenges of Emerging Technologies in Transportation Systems

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### ABSTRACT

*Nowadays, the number of vehicles and the need for transportation is growing quickly. There are more vehicles on the roads driving more kilometers. The road networks in major cities are not sufficient to cater for the current traffic demands due to the size of roads available. As a result, the modern society is facing more traffic jams, higher fuel bills and the increase of CO<sub>2</sub> emissions. It is imperative to improve the safety and efficiency of transportation. Developing a sustainable transportation system requires a better use of existing infrastructure and the application of emerging technologies. This chapter gives the readers a global vision of the traffic and transportation issues and how emerging technologies such as wireless, sensing, cellular and computing technologies contribute to the solution of transportation problems in all cities of the world.*

### INTRODUCTION

Modern society depends on mobility, which provides personal freedom and access to services for business and pleasure. The amount of time to travel from one location to another can vary significantly based on the current traffic conditions. The growing volume of traffic has adverse effects on the environment, public health and especially in accidents that cause fatalities, injuries

and material damages. Vehicular traffic is one of the most critical concerns for a modern society where cities are ever-growing. It is of paramount importance to improve the safety and efficiency of transportation. In order to solve these serious transportation problems, the proposed solutions must be based on intelligent mechanisms and the application of emerging technologies to make traffic control and management more efficient and safety. Several research groups focus their attention on the emerging technologies as a feasible alternative to solve the transportation problems

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(Chatzigiannakis, Grammatikou & Papavassiliou, 2007; Qing, Mak, Jeff & Sengupta, 2007).

Technological advances in communications, electronics, and computing capabilities are contributing to improve the transportation systems, creating the vision towards more intelligent transportation systems. These systems, which are known as *Intelligent Transportation Systems* (ITS), attempt to apply information and communications technologies to vehicles and transportation infrastructure to manage items that are typically independent of each other, such as vehicles, loads, and routes. The final goal is to improve safety and reduce vehicle wear, transportation times, and fuel consumption. ITS can contribute to the transportation solution applying the latest information and communication technologies, such as wireless, sensing, cellular, mesh, and computing technologies to transportation systems. However, the intelligent level depends on technological integration level and the technologies used or applied (Figure 1). When integrated into the transportation system's infrastructure, and in vehicles themselves, these technologies relieve congestion, improve safety and enhance productivity. The main challenge will be to integrate all technologies within a complementary and cooperative environment that

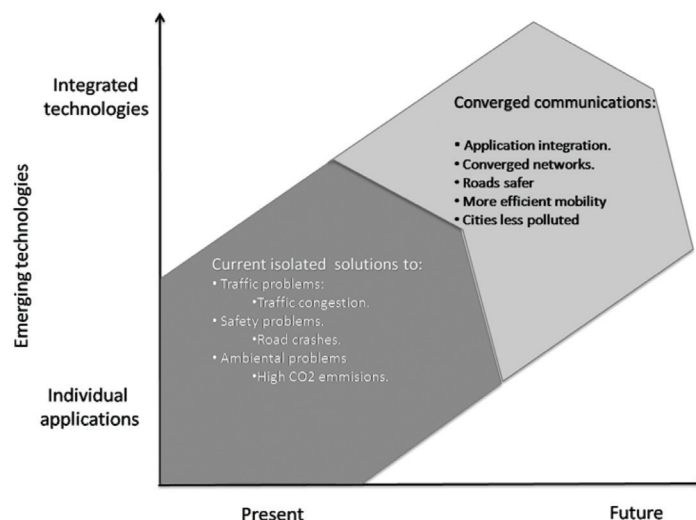
solves the transportation problems. The proposal of a new cooperative environment composed by different network technologies and integrated applications will focus on creating safer roads, more efficient mobility and minimizing the environmental impact. Additionally, the development of predictive techniques and algorithms will allow transportation systems to increase their grade of intelligence by means of advanced modeling and comparison of historical baseline.

It will be necessary to accelerate and coordinate the deployment and use of *ITS* applications and services for road transport and their connections with other modes of transport, to ensure seamless access and continuity of services. In this sense, EU has proposed an action plan that includes specific measures in these areas (Mobility and Transport, 2009):

- Optimal use of road and traffic data.
- Traffic and freight management.
- Road safety and security.
- Integrating ITS applications in the vehicle.
- Data protection and liability.

The direct benefit will be a faster, better coordinated and more harmonized use of intelligent

Figure 1. Vision of the future of intelligent transportation systems



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