Chapter 16
Telematics and Mobile Internet:
Current Situation and 5G Networks

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ABSTRACT

Telematics technologies and vehicular communications enable various intelligent transportation system applications with different data flow requirements that must be considered by the communications infrastructure provider in terms of transmission reliability, latency, jitter, and security. To meet those requirements, the dynamic nature of traffic and spatiotemporal features of roads must be considered. In parallel with the full coverage in urban areas and increase in the data rates, mobile networks have been started to be widely used by intelligent transportation system applications, especially for gathering data from various sensors. In this chapter, firstly, the current situation of telematics applications for intelligent transportation system is focused on and then mobile internet and mobile internet based applications are reviewed. Second, how much benefit vehicle telematics and mobile internet applications can obtain from the evolution of mobile networks is analysed. Finally, future research directions in this domain are pointed out.

INTRODUCTION

Since a city's transport system acts as a lifeline for the smooth functioning of the city, intelligent cities need well planned and efficiently managed transport services. However, in recent years, traffic jams have become a serious issue, started to impact our everyday lives as well as economic growth of countries and necessitated the emergence of various applications, such as real-time traffic news delivery, dynamic routing and intelligent parking guidance. Although navigation systems provide the shortest routes in length, most of the time taking the shortest path in length to a destination results in getting stuck in

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the middle of a traffic jam. Nevertheless, thanks to adaptive traffic control systems, some unnecessary delays can be eliminated. Therefore, instead of providing the directions about how to get a specific destination, navigation system developers should focus on providing the best possible shortest path in time to a specific destination. One of the efficient approaches to this problem is to dynamically assign maximum speed for each road by taking into consideration road conditions, weather conditions, and accident reports so that traffic conditions can be efficiently managed. In this approach, link speeds are calculated centrally and then transmitted to the road side units; so any vehicle connected to these road units obtain the assigned speed automatically. The connections between the road side units and vehicles are realised using short-range wireless technologies such as Bluetooth, ZigBee, Infrared, Dedicated Short-Range Communications (DSRC), or Communications Air Interface for Long and Medium Range (CALM). A complementary approach is Adaptive Traffic Light Control System (ATLCS). ATLCS is a traffic management strategy in which traffic signal timing changes, or adapts, based on actual traffic demand. ATLCS gathers information from various sources such as via Global Positioning System (GPS) signals, loop detectors, and cameras, and dynamically adjusts cycle time of traffic lights nearby a congested region so that the delay resulting from the traffic jam is minimised (Ezawa & Mukai, 2010).

As well as traffic management related approaches, a valuable tool that contributes to both car safety and road safety is Advanced Driver-Assistance System (ADAS). ADAS can detect some objects, do basic classification, alert the driver of hazardous road conditions, and slow or stop the vehicle. ADAS is a great tool for forward collision warning, lane-keep assistance, and blind spot monitoring. The problems of mobility in cities are clear and a shift from the private automobile to a multi-modal approach which comprises of trains, metros, buses, and other individual transport modes or a combination of these, is the preferred trend. It is obvious that there is a need for both high-speed scheduled mass transport and individualised on-demand short distance transport. With the capabilities of emerging technologies, new solutions can address the need if they can be tested and evaluated thoroughly for certification of intelligent transport systems on a continent or worldwide level. Because, guaranteeing the compliance with the upcoming standards of intelligent transportation system components is critically important to ensure that the results have long-term validity.

Intelligent transportation system can be subcategorised as car-to-car communications, advanced traveller information services, safety applications, electronic toll collection (ETC) services, adaptive traffic lights, etc. Although advanced traveller information system employs different methods for retrieving and processing real-time data, collecting floating car data with the help of GPS is the most commonly used method. Compared to the past, nowadays accurate and reliable position and velocity data are easily produced using GPS and dead-reckoning data when combined with a detailed map (Cho, Bae, Chu, & Suh, 2006). If implemented properly, each vehicle can use position and velocity data to build and maintain a dynamic map of its surroundings so that situational awareness and extrapolations can be realised to identify potential hazards. On the other hand, the availability of high-precision maps and well-mapped fixed infrastructure objects along the road can be used to increase the reliability and accuracy of this approach. Retrieving data from the existing mobile applications via FM Receiver and Radio Data System (RDS) channel is another common method.

Narrowband - The Internet of Things (IoT) (NB-IoT) is a Low Power Wide Area Network (LPWAN) radio technology to enable a wide range of cellular devices and services. Specifically focused on indoor coverage, NB-IoT provides high connection density, long battery life, and low cost. It uses a subset of the Long Term Evolution (LTE) standard, however it limits the bandwidth to a single narrow-band of 200 KHz. Therefore, it is ideal for devices that generate low data traffic and have a long life cycle. Since