



Advanced formation and delivery of traffic information in intelligent transportation systems [☆]

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ABSTRACT

To meet the safety requirement for the increasing traffic densities nowadays, there exists a growing demand for advanced systems that can provide drivers essential traffic and travel information to improve road safety and traffic efficiency. In this paper, we combine the video analysis and multimedia networking technologies to present a highly integrated intelligent system that can achieve the above goals. For traffic information, the system presented in this paper collects traffic parameters and detects relevant events by analyzing traffic surveillance videos. Through robust tracking algorithms and reasoning logics, important traffic parameters and events are extracted from the surveillance videos accurately. Afterwards, summarized real-time traffic conditions and important events along with corresponding live traffic videos are formed into layers and multicasted through an integration of WiMAX infrastructure and vehicular ad hoc networks (VANET). By the support of adaptive modulation and coding in WiMAX, the radio resources can be optimally allocated when performing multicast so as to dynamically adjust the number of data layers received by users. In addition to multicast supported by WiMAX, we also design a knowledge propagation and information relay scheme by VANET. Through this relaying technology, about 80% of the mobile stations that were unable to subscribe additional layers of data due to insufficient downlink bandwidth from WiMAX could regain more than 90% of the data in the additional layers within tolerable buffering time.

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1. Introduction

Intelligent transportation systems (ITS) integrate advanced electronics, communications, sensing and information technologies to design management strategies for streets, vehicles and people. Intelligent vehicles can be equipped with many kinds of sensors, powerful computing capabilities, sophisticated software systems, and large communication capacities (Chen, 2011; Wang, 2006). Connecting intelligent vehicles with one another and with their driving environment is a growing trend in ITS (Li, Song, Wang, Niehsen, & Zheng, 2005). With the increasing traffic density, a traffic and travel information multicasting system that provides real-time information to drivers can substantially improve road safety and traffic efficiency. In this paper, we combine the video analysis

and multimedia networking technologies to present a highly integrated intelligent system that can achieve the above goal.

The system architecture for the proposed advanced traffic and travel information multicasting system is illustrated in Fig. 1. The roadside cameras capture the traffic surveillance videos of major intersections or highway sections and send the videos back to the local traffic service center, which is responsible for analyzing the received surveillance videos to obtain the desired traffic parameters and events. To accomplish the task, the system segments out the foreground objects from the surveillance videos and perform tracking on the objects. Traffic parameters are computed from the statistics of the tracking results, and events are detected either by establishing rule-based reasoning logic or training appropriate recognition models using training data. After the traffic parameters and the events are extracted, the information is multicasted through the wide-range wireless infrastructure. In the work proposed by Liu, Yoo, Jang, Choi, and Hwang (2005), scalable geo-referenced videos and geographic information are transmitted to GPS-guided vehicles. The feasibility of multicasting real-time traffic data to mobile stations is inspired by the work (Liu et al., 2005). In addition to the traffic conditions, the drivers

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