INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATIONS AND ROBOTICS
ISSN 2320-7345

INTELLIGENT TRANSPORT WITH REAL TIME DATA ANALYSIS

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Abstract: - Intelligent Transport Systems (ITS) are vital to increase safety and tackle growing emission and congestion problems. They can make transport safer, more efficient and more sustainable by applying various information and communication technologies to all modes of passenger and freight transport. Moreover, the integration of existing technologies can create new services. ITS are key to support jobs and growth in the transport sector. Connecting Traffic Management System (Traffic signals and Traffic Command centers) with a GIS enabled digital road map of the city and using the power of analytics is a key to smooth traffic management. Using real time analytics of data from these sources and linking them to some trends, we can manage traffic flow much better. Data analytics tools get data from the Traffic Management System, align this in real time with GIS mapping and parking management data provide information to the driver, thus help reducing traffic pile up. Also, information from these systems are being projected in real time on digital screens installed at City Center entrances, guiding drivers to available parking slots and streets. This not only helps reduce congestion but also saves lot on time and fuel, thus making environment cleaner and better to live.

KEYWORDS: Introduction; Intelligent transport systems; Data Analytics; Radio Modem Communication

Introduction

Intelligent Transportation Systems (ITS) is the application of computer, electronics, and communication technologies and management strategies in an integrated manner to provide traveler information to increase the safety and efficiency of the surface transportation systems. These systems involve vehicles, drivers, passengers, road operators, and managers all interacting with each other and the environment, and linking with the complex infrastructure systems to improve the safety and capacity of road systems[1]. ITS improves transportation safety and mobility and enhances global connectivity by means of productivity improvements achieved through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. Intelligent transportation systems encompass a broad range of wireless and wire line communication based information and electronics technologies to better manage traffic and maximize the utilization of the existing transportation infrastructure [10]. It improves driving experience, safety and capacity of road systems, reduces risks in transportation, relieves traffic congestion, improves transportation efficiency and reduces pollution. This paper mainly describes ITS user services, ITS architecture and ITS planning. The various user services offered by ITS have been divided in eight groups have been briefly described. The ITS architecture which provides a common framework for planning, defining, and integrating intelligent transportation systems is briefly described emphasizing logical and physical architecture. Integration of ITS in transportation planning process which follows a systems engineering approach to develop a transportation plan is also briefly described in this paper.

Intelligent transport systems

ITS will be used to improve journeys and operations on specific and combined modes of transport. Intelligent transport systems vary in technologies applied, from basic management systems such as car navigation; traffic signal control systems; container management systems; variable message signs; automatic number plate recognition or speed cameras to monitor applications, such as security **CCTV** systems; and to more advanced applications that integrate live data and feedback from a number of other sources, such as parking guidance and information systems; weather information; bridge de-icing (US deicing) systems; and the like. Additionally, predictive techniques are being developed to allow advanced modeling and comparison with historical baseline data. Some of these technologies are described in the following sections.

Data Analytics

The Intelligent Transportation Systems (ITS) have collected a large amount of structured/unstructured traffic data. This large amount of data provide a good platform to develop new paradigms and strategies in system design, system development, information processing, and performance evaluation in Intelligent[2] Transportation Systems. In the past a few years, extensive research efforts have been dedicated to computational models that analyze and process these large-scale data, but effective tools to manipulate them are still at their infancy[12]. A few key technical challenges are as follows: 1) the difficulty to efficiently and effectively discover low-level and high-level visual features for large-scale traffic data analysis; 2) the challenge to implement a real-time surveillance system that accurately track different vehicles and pedestrians; and 3) the necessity to build an intelligent system that dynamically visualizes the statistics of the large-scale traffic data. This special issue will focuses on the most recent technical progresses on the big data driven applications for ITS, e.g., data processing methods, data-driven computing techniques, and application-oriented system models. *Data Analytics for Intelligent Transportation Systems* provides in-depth coverage of data-enabled methods for analyzing intelligent transportation systems that includes detailed coverage of the tools needed to implement these methods using big data analytics and other computing techniques. With **big data** and analytics (both descriptive and predictive), practitioners are able to derive much useful insights pertaining to the various data sets. Combined with association rules, relationships between specific values of categorical variables in large data sets are detected. These powerful multivariate exploratory techniques enable analysts to uncover hidden pattern in large data sets. However, what is lacking here is the capability to visualize how one objective function affects another objective function, and the trade-off between them.

Floating car data/floating cellular data

"Floating car" or "probe" data collection is a set of relatively low-cost methods for obtaining travel time and speed data for vehicles traveling along streets, highways, freeways, and other transportation routes. Broadly speaking, three methods have been used to obtain the raw data:

- **Triangulation Method.** In developed countries a high proportion of cars contain one or more mobile phones. The phones periodically transmit their presence information to the mobile phone network, even when no voice connection is established. In the mid-2000s, attempts were made to use mobile phones as anonymous traffic probes. As a car moves, so does the signal of any mobile phones that are inside the vehicle. By measuring and analyzing network data using triangulation, pattern matching or cell-sector statistics (in an anonymous format), the data was converted into traffic flow information. With more congestion, there are more cars, more phones, and thus, more probes. In metropolitan areas, the distance between antennas is shorter and in theory accuracy increases. An advantage of this method is that no infrastructure needs to be built along the road; only the mobile phone network is leveraged. But in practice the triangulation method can be complicated, especially in areas where the same mobile phone towers serve two or more parallel routes (such as a freeway with a frontage road, a freeway and a commuter rail line, two or more parallel streets, or a street that is also a bus line). By the early 2010s, the popularity of the triangulation method was declining.

- **Vehicle Re-Identification.** Vehicle re-identification methods require sets of detectors mounted along the road. In this technique, a unique serial number for a device in the vehicle is detected at one location and then detected again (re-identified) further down the road. Travel times and speed are calculated by comparing the time at which a specific device is detected by pairs of sensors. This can be done using the MAC (Machine Access Control) addresses from Bluetooth devices, or using the RFID serial numbers from Electronic Toll Collection (ETC) transponders (also called "toll tags").

- **GPS Based Methods.** An increasing number of vehicles are equipped with in-vehicle GPS (satellite navigation) systems that have two-way communication with a traffic data provider. Position readings from these vehicles are used to compute vehicle speeds.

Floating car data technology provides advantages over other methods of traffic measurement:

- Less expensive than sensors or cameras
- More coverage (potentially including all locations and streets)
- Faster to set up and less maintenance
- Works in all weather conditions, including heavy rain

Radio Modem Communication: Radio modem communication on UHF and VHF frequencies are widely used for short and long range communication within ITS.ITS encompass a broad range of wireless and wire line communications-based information and electronics technologies. Short-range communications (less than 500 yards) can be accomplished using IEEE 802.11 protocols, specifically WAVE or the Dedicated Short Range Communications standard being promoted by the Intelligent Transportation Society of America and the United States Department of Transportation. Theoretically, the range of these protocols can be extended using Mobile ad-hoc networks or Mesh networking. Longer range communications have been proposed using infrastructure networks such as WiMAX (IEEE 802.16), Global System for Mobile Communications (GSM), or 3G. Long-range communications using these methods are well established, but, unlike the short-range protocols, these methods require extensive and very expensive infrastructure deployment. There is lack of consensus as to what business model should support this infrastructure. ITS technology-based systems are intended to facilitate the realization of optimized, efficient, smooth, and comfortable transport systems to improve traffic flow and reduce bottlenecks of traffic congestion. These systems integrate modern information and communication technology into existing transportation systems. The demand for radio modems in ITS is increasing because radio modems require minimal infrastructure for facilitating communication and ensuring delivery of data, voice, and video in the most cost-effective and reliable manner. Radio modems are also useful in data communication within a large geographic area, where wired data communication is not viable due to high costs involved. Radio modems are also required to facilitate ITS for implementing wireless networks that are cost-effective and flexible.

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