A Review Paper on Intelligent Transpotation System

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I. INTRODUCTION

Intelligent transportation 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 monitoring 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 deicing systems; and the like.

Intelligent Transportation Systems (ITS) is the term used to describe the application to road transportation of advanced technologies including computing, sensors, communications, and controls. ITS is comprised of a number of technologies, including information processing, communications, control, and electronics. Joining these technologies to our transportation system will save lives, save time, and save money.

II. OBJECTIVE AND SCOPE

The main objective of Intelligent Transportation systems is to provide solution to the current drawbacks in transportation systems, and to provide a reliable bus service network which will attract more people to use the same, reduce air pollution by motivating people to use public transport system,, it provides a lot of advantages with a modification to the current infrastructure and systems.

INTELLIGENT TRANSPORTATION TECHNOLOGIES WIRELESS COMMUNICATIONS

Various forms of wireless communications technologies have been proposed for intelligent transportation systems. 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.

COMPUTATIONAL TECHNOLOGIES

Recent advances in vehicle electronics have led to a move toward fewer, more capable computer processors on a vehicle. A typical vehicle in the early 2000s would have between 20 and 100 individual networked microcontroller/Programmable logic controller modules with non-real-time operating systems. The current trend is toward fewer, more costly microprocessor modules with hardware memory management and Real-Time Operating Systems. The new embedded system platforms allow for more sophisticated software applications to be implemented, including model-based process control, artificial intelligence, and ubiquitous computing. Perhaps the most important of these for Intelligent Transportation Systems is artificial intelligence.

FLOATING CAR DATA/FLOATING CELLULAR DATA

Virtually every car contains one or more mobile phones. These mobile phones routinely transmit their location information to the network – even when no voice connection is established. This allows them to be used as anonymous traffic probes. As the car moves, so does the signal of the mobile phone. By measuring and analyzing triangulation network data – in an anonymous format – the data is converted into accurate 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, thus, accuracy increases. No infrastructure needs to be built along the road; only the mobile phone network is leveraged.

SENSING TECHNOLOGIES

Technological advances in telecommunications and information technology coupled with state-of-the-art microchip, RFID, and inexpensive intelligent beacon sensing technologies have enhanced the technical capabilities that will facilitate motorist safety benefits for intelligent transportation systems globally. Sensing systems for ITS are vehicle and infrastructure based networked systems, e.g., Intelligent vehicle technologies. Infrastructure sensors are indestructible (such as in-road reflectors) devices that are installed or embedded on the road, or surrounding the road (buildings, posts, and signs for example) as required and may be manually disseminated during preventive road construction maintenance or by sensor injection machinery for rapid deployment of the embedded radio frequency powered (or RFID) in-ground road sensors. Vehicle sensing systems include deployment of infrastructure-to-vehicle and vehicle-to infrastructure electronic beacons for identification communications and may also employ the benefits of CCTV automatic number plate recognition technology at desired intervals in order to increase sustained monitoring of suspect vehicles operating in critical zones.

INDUCTIVE LOOP DETECTION

Inductive loops can be placed in a roadbed to detect vehicles as they pass over the loop by measuring the vehicle's magnetic field. The simplest detectors simply count the number of vehicles during a unit of time (typically 60 seconds in the United States) that pass over the loop, while more sophisticated sensors estimate the speed, length, and weight of vehicles and the distance between them. Loops can be placed in a single lane or across multiple lanes, and they work with very slow or stopped vehicles as well as vehicles moving at high speed.

VIDEO VEHICLE DETECTION

Traffic flow measurement and automatic incident detection using video cameras are another form of vehicle detection. Since video detection systems such as those used in automatic number plate recognition do not involve installing any components directly into the road surface or roadbed, this type of system is known as a "non-intrusive" method of traffic detection. Video from black-and white or color cameras is fed into processors that analyze the changing characteristics of the video image as vehicles pass. This usually involves inputting known measurements such as the distance between lane lines or the height of the camera above the roadway. Some systems provide additional outputs including gap, headway, stopped-vehicle detection, and wrong-way vehicle alarms.

KEY UNDERLYING TECHNOLOGIES FOR ITS

GLOBAL POSITIONING SYSTEM (GPS)

Embedded GPS receivers in vehicles' on-board units (OBUs, a common term for telematics devices) receive signals from several different satellites to calculate the device's (and thus the vehicle's) position. This requires line of sight to satellites, which can inhibit use of GPS in downtown settings due to "urban canyon" effects. Location can usually be determined to within ten meters. GPS is the core technology behind many in-vehicle navigation and route guidance systems. Several countries, notably Holland and Germany, are using or will use OBUs equipped with satellite-based GPS devices to record miles traveled by automobiles and/or trucks in order to implement user fees based on vehicle miles traveled to finance their transportation systems.

NETWORKS

Similar to technology commonly used for wireless Internet access, wireless networks allow rapid communications between vehicles and the roadside, but have a range of only a few hundred meters. However, this range can be extended by each successive vehicle or roadside node passing information onto the next vehicle or node. South Korea is increasingly using WiBro, based on WiMAX technology, as the wireless communications infrastructure to transmit traffic and public transit information throughout its transportation network.

MOBILE TELEPHONY

ITS applications can transmit information over standard third or fourth generation (3G or 4G) mobile telephone networks. Advantages of mobile networks include wide availability in towns and along major roads. However, additional network capacity may be required if vehicles are fitted with this technology, and network operators might need to cover these costs. Mobile telephony may not be suitable for some safety-critical ITS applications since it may be too slow.

ROADSIDE CAMERA RECOGNITION

Camera- or tag-based schemes can be used for zone-based congestion charging systems (as in London), or for charging on specific roads. Such systems use cameras placed on roadways where drivers enter and exit congestion zones. The cameras use Automatic License Plate Recognition (ALPR), based on Optical Character Recognition (OCR) technology, to identify vehicle license plates; this information is passed digitally to back-office servers, which assess and post charges to drivers for their use of roadways within the congestion zone.

PROBE VEHICLES OR DEVICES

Several countries deploy so-called “probe vehicles” (often taxis or government-owned vehicles equipped with DSRC or other wireless technology) that report their speed and location to a central traffic operations management center, where probe data is aggregated to generate an area-wide picture of traffic flow and to identify congested locations. Extensive research has also been performed into using mobile phones that drivers often carry as a mechanism to generate real-time traffic information, using the GPS-derived location of the phone as it moves along with the vehicle. As a related example, in Beijing, more than 10,000 taxis and commercial vehicles have been outfitted with GPS chips that send travel speed information to a satellite, which then sends the information down to the Beijing Transportation Information Center, which then translates the data into average travel speeds on every road in the city.

INTELLIGENT TRANSPORTATION APPLICATIONS

ELECTRONIC TOLL COLLECTION

Electronic toll collection at "Costanera Norte" Freeway, downtown Santiago, Chile Main article: Electronic toll collection (ETC) makes it possible for vehicles to drive through toll gates at traffic speed, reducing congestion at toll plazas and automating toll collection. Originally ETC systems were used to automate toll collection, but more recent innovations have used ETC to enforce congestion pricing through cordon zones in city centers and ETC lanes. Until recent years, most ETC systems were based on using radio devices in vehicles that would use proprietary protocols to identify a vehicle as it passed under a gantry over the roadway. More recently there has been a move to standardize ETC protocols around the Dedicated Short Range Communications protocol that has been promoted for vehicle safety by the Intelligent Transportation Society of America, ERTICO and ITS Japan. While communication frequencies and standards do differ around the world, there has been a broad push toward vehicle infrastructure integration around the 5.9 GHz frequency (802.11.x WAVE). Via its National Electronic Tolling Committee representing all jurisdictions and toll road operators, ITS Australia also facilitated interoperability of toll tags in Australia for the multi-lane free flow tolls roads. Other systems that have been used include barcode stickers, license plate recognition, infrared communication systems, and Radio Frequency Identification Tags (see M6 Toll tag).

EMERGENCY VEHICLE NOTIFICATION SYSTEMS

The in-vehicle eCall is an emergency call generated either manually by the vehicle occupants or automatically via activation of in-vehicle sensors after an accident. When activated, the in-vehicle eCall device will establish an emergency call carrying both voice and data directly to the nearest emergency point (normally the nearest E1-1-2 Public-safety answering point, PSAP). The voice call enables the vehicle occupant to communicate with the trained eCall operator. At the same time, a minimum set of data will be sent to the eCall operator receiving the voice call.

The minimum set of data contains information about the incident, including time, precise location, the direction the vehicle was traveling, and vehicle identification. The pan-European eCall aims to be operative for all new type-approved vehicles as a standard option. Depending on the manufacturer of the eCall system, it could be mobile phone based (Bluetooth connection to an in vehicle interface), an integrated eCall device, or a functionality of a broader system like navigation, Telematics device, or tolling device. E-Call is expected to be offered, at earliest, by the end of 2010, pending standardization by the European Telecommunications Standards Institute and commitment from large EU member states such as France and the United Kingdom.

AUTOMATIC ROAD ENFORCEMENT

A traffic enforcement camera system, consisting of a camera and a vehicle-monitoring device, is used to detect and identify vehicles disobeying a speed limit or some other road legal requirement and automatically ticket offenders based on the license plate number.

COLLISION AVOIDANCE SYSTEMS:

Japan has installed sensors on its highways to notify motorists that a car is stalled ahead.

DYNAMIC TRAFFIC LIGHT SEQUENCE

Intelligent RFID traffic control has been developed for dynamic traffic light sequence. It has circumvented or avoided the problems that usually arise with systems such as those, which use image processing and beam interruption techniques. RFID technology with appropriate algorithm and data base were applied to a multi vehicle, multi-lane and multi road junction area to provide an efficient time management scheme. A dynamic time schedule was worked out for the passage of each column. The simulation has shown that, the dynamic sequence algorithm has the ability to intelligently adjust itself even with the presence of some extreme cases. The real time operation of the system able to emulate the judgment of a traffic policeman on duty by considering the number of vehicles in each column and the routing proprieties.

III. CONCLUSION

The results of this literature review have shown that many benefits are obtained through deployments of ITS systems in an existing transportation system. Based on documented experience locally and throughout the country, ITS deployments in current scenario have the potential to offer major benefits. Even though the Intelligent Transportation system (ITS) provides the major advantages over the existing Transportation system, the implementation of such system depends on the Government, and proper awareness of the applications in the ITS system should be made available to the common public, And finally there is a need for further development of this system to make more convenient and more cost effective.

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