Intelligent Transportation Systems

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Abstract

In the 21st century, the technology development mainstream is the interdisciplinary integration, together with the human-centered technologies (i.e., Human-Technologies, HT) that emphasizes on friendly service for human rather than the forced adaptation by human. Intelligent Transportation Systems (ITS) represents a typical human-centered large-scale and highly complex dynamic system, while it is the mainstream of the development of next-generation technologies. ITS is an integrated discipline of sensing, controls, computers, electronics, communications and traffic management. It is aimed to provide the traveler information to increase safety, efficiency, and reduce traffic jam, pollution and energy consumption, therefore a more humanistic transportation system. In this thinking, new research topics and human-oriented technologies emerge, e.g., increasing machine intelligence (Machine IQ), human-in-the-loop control system technology (Human-centered Control), human-based intelligent dialogue interface technology (Human-based Interfacing), vision and communication supported and enhancement systems (Smart Vision, Smart Networking), human physical conditions detection and intelligent control technology (Intelligent Control), multi-agent for large-scale systems to support information analysis (Large-Scale System Analysis). Based on the above emerging topics, advanced fundamental researches on the human-oriented technologies and next-generation core technologies of ITS (i.e., HT-ITS) are major focused issues in this research. This research is organized into five subprograms, each consisting of both fundamental research and application studies, listed as follows:

1. *Smart Vision* – Biological-inspired Intelligent Vision Technology for ITS: Combining brain science and intelligent engineering to develop biological-inspired computer vision (*e-Eye* – electronic eye) techniques for ITS applications.

2. *Smart Interfacing* – Intelligent Dialogue System for ITS Information Access: Combining speech recognition and language processing to develop intelligent spoken dialogue system for accessing ITS information.
3. *Smart Car* – Intelligent Control for Next-Generation Smart Cars: Combining intelligent control, power electronics and network control techniques to develop intelligent wheels (I-Wheels) and intelligent adaptive cruise control systems for ITS applications.
4. *Smart Networking* – High-Capacity Communication Networks for ITS: Developing and integrating the wireless communication networks and transportation networks technologies into the broadband wireless ITS network.
5. *Smart Agent* – Agent-based Software Engineering for ITS: Developing a systematic methodology for building multi-agent systems in an incremental manner based on the notion of trade-off analysis of agents' goals for ITS applications.

One objective of this research is constructing and building the infrastructure of the information and communication platforms for system integration, verification, and demonstration of all the subprograms. In this talk , we demonstrated the ITS DSRC (Dedicated Short-Range Communications) applications, hand-over capability and mobility enhancement of the DSRC network. The applications of Advanced Traveler Information Systems (ATIS) by integrating ITS vision systems, network traffic dynamics simulation, smart interfacing and networking, and smart agent systems are also real-life demonstrated. The experimental car (TAIWAN iTS-1) also successfully demonstrated the autonomous intelligent lane-keeping driving at velocity 90km/hr-110km/hr on Taiwan National Freeway No.3 and Expressway No.68.

We believe that the proposed efforts will in turn enrich our research and teaching environment, reinforce our academic strength and open up new territory applications for each discipline. Equally importantly, the success of our efforts should bring social and economical benefits, in addition to academic values.