Bumjoon Bae

University of Tennessee, Knoxville

ITSTN Scholarship Essay

27 March 2015

ITS: Real Progress, Great Future

Intelligent Transportation Systems (ITS) are advanced applications combined with intelligent technologies, such as information and communication, control engineering and sensing technologies, in order to use transportation systems more safely and efficiently. ITS systems have been introduced decades ago and now it is taking on a new paradigm in USA, Europe and Asian countries. It refers to the next generation of ITS for forming the safer, more efficient and environment friendly transportation systems through connectivity between vehicles (V2V) or vehicle and roadside infrastructure (V2I) using wireless communication technologies, named the Connected Vehicle (CV) in USA and the Cooperative-ITS (C-ITS) in Europe and Asia. The 'connectivity' can be regarded widely as communications between drivers, system operators and wireless devices, e.g. smart phones, as well as between vehicles or vehicle and roadside infrastructure. This essay discusses the effects of the ITS focusing on the CV technologies on our future, some concerns about them and the transportation engineering's role for leading safe changes.

Most of advanced countries including USA have established and implemented transportation plans in which improving traffic safety is selected as the first priority strategy[1]. The

---

[1] U.S. Department of Transportation (2014), *Transportation for a new generation: Strategic plan 2014-18.*
   U.S. Department of Transportation (2014), *ITS strategic plan 2015-2019*.

CV technologies can contribute directly to traffic safety by helping drivers to avoid traffic crash circumstances. They can provide information for safe driving to drivers who located in a certain radius via an in-vehicle unit though short distance vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) communications; raise awareness of road traffic conditions by signaling hazardous road circumstances; and warn collision risks. Furthermore, they can control a vehicle's steering and braking maneuvering automatically in combination with automatic control or autonomous vehicle technologies and improve traffic signal timing plans. According to the study of U.S. Department of Transportation, 81 percent of total vehicle crashes on roadway can be potentially addressed by the CV technologies if the combined V2V and V2I technologies are widespread[2].

Another significant objective of ITS including CV is enhancing mobility which is improving the system efficiency by increasing road capacity relieving traffic congestion. The traffic congestion has recognized as a major social problem in most of countries which are facing urbanization. Governors and traffic system operators have put efforts for increasing efficiency of the traffic system by encouraging development and introduction of ITS technologies, while implementing traffic demand management strategies which aim to change people's travel behavior through policies or campaigns. CV technologies can decrease stop delay time in an intersection by providing real time information, which is helpful for safe driving, consequentially decrease delay time and increase driving speed of individual vehicle in terms of a microscopic aspect. These result in more stabilized traffic flow and shorter gap distances, so that great increase of roadway capacity in a macroscopic aspect. In order for that, vehicle information (location, speed, acceleration and deceleration rate and vehicle events), traffic information (average speed, traffic volume and

---

[2] U.S. Department of Transportation (2010), *Frequency of target crashes for IntelliDrive Safety System.*

occupancy rate) and event information (traffic signal timing, incident warning and road surface conditions) are transmitted between V2V and V2I.

Apart from the CV, autonomous vehicle technologies are being developed rapidly with growing interest from the public and related industries. Google has shown an autonomous vehicle using 3D radar, location based information, image processing technologies and so on, and finished the successful road testing on public roads logging nearly 700,000 miles without an accident. Although the CV and autonomous vehicle technologies have been recognized, studied and developed separately so far, it is obvious that the CV will be evolved into the autonomous vehicle and the autonomous vehicle technologies can also make a complete automation of traffic systems by integrating with CV. Then, all benefits discussed above can be ultimately maximized in the future.

ITS technologies have been advanced already in many ways and we are about to the inflection point of great following changes in our transportation systems. Such changes will make the present traffic environment safer and more efficient and provide nontrivial driving force of sustainable economic growth. However, some have expressed concerns about the technological advances. For instance, the CVs and autonomous vehicles which make using a vehicle being easier with less effort than heretofore will increase travel demand for cars necessarily. Despite the effect of road capacity increase, new problems of traffic congestion, energy consumption and emission might resurface by the induced demand. In addition, an ethical issue or an unclear responsibility problem might be emerged in unavoidable traffic incidents due to the decision making by a vehicle or computer instead of a driver.

In spite of those concerns, we are not able to avoid the changes due to the technology progress and speed of them may be much faster than our expectation as if we can't imagine a life

without a smartphone which has appeared about few years ago. Mankind have been adapted well by seeking proper policy changes to be harmonized with an existing system whenever they face a rapid change due to a technological revolution. In order for a soft landing of the ITS systems, transportation engineering has to cooperate in expanding the academic and research scope to the IT and automatic control engineering fields based on understanding of human factors and suggests direction for development of ITS.

Transportation systems have changed along development of technologies and they keep change now. ITS technologies focusing on CV will definitely create new traffic environment and we will be the first generation to observe and accommodate to the changes.