ATLANTIC

A Thematic Long-term Approach to Networking for the Telematics & the ITS Community

Work Group 2.2

Intelligent Vehicles & Intelligent Vehicle-Highway Systems

DISCUSSION PAPER OUTLINE

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Work Group 2.2

TITLE

Intelligent Vehicles & Intelligent Vehicle-Highway Systems

SCOPE

- Intelligent systems and sensors for control and monitoring of vehicle behavior
- Intelligent systems and sensors for driving assistance and automation
- Embedded intelligent systems and sensors in vehicle guidance, navigation and telematics

PURPOSE

The purpose of this discussion paper outline is to introduce the theme of Work Group 2.2 of the Canadian ATLANTIC Project and to initiate dialogue to develop the discussion paper. The ATLANTIC network is focused on exploring intelligent transportation systems (ITS) applications to transportation in the participating countries of Europe, Canada and the United States.

Work Group 2.2 is focused on the application of ITS in vehicles and in vehicle-highway systems. The largest part of the vehicle fleet is dedicated to private personal transportation but this Work Group will also include commercial vehicles within its scope.

PROPOSED DISCUSSION TOPICS

In the present IVHS context, intelligent systems and sensors (I2S) refers to a broad range of diverse technologies including information processing, communications, control, and electronics embedded in vehicles and highway infrastructures. With the recent advances and breakthrough in areas such as information and computing technologies, in sensors and in displays, joining these technologies to our transportation system will make road transportation safer, easier, cleaner and cheaper. In this working group we will consider I2S according to some sub-theme areas such as:

1) I2S for control and monitoring of vehicle behavior,

The application of advanced electronic technology to transportation vehicle performance has opened up many exciting research areas in order to make the vehicles "smarter" such as electronic suspensions, integrated chassis control systems, airbags active control systems, mission control, active noise control, thermal control systems, in-cylinder combustion control, advanced thermal control systems and active traction control.

2) I2S for driving assistance and automation,

These I2S systems allow for the development, availability, and use of driving assistance systems to reduce deaths, injuries, property damage and the societal loss that result from motor vehicle crashes. These systems would help drivers to process information, make decisions, and operate vehicles more effectively, efficiently, and with increased productivity. This sub-theme will also exploit cameras, sensors and fast information processing to provide an interface between driver and non-safety-critical in-vehicle controls and display systems.

3) I2S in vehicle guidance, navigation and telematics.

Collect and transmit information on traffic conditions and transit schedules for travelers before and during their trips. Alerted to hazards and delays, travelers can change their plans to minimize inconvenience and additional strain on the system. Decrease congestion by reducing the number of traffic incidents, clearing them more quickly when they occur, rerouting traffic flow around them, and automatically collecting tolls. Improve the productivity of commercial, transit, and public safety fleets by using automated tracking, dispatch and weigh-in-motion systems that speed vehicles through much of the red tape associated with long route commerce. Assist drivers in reaching a desired destination with navigation systems enhanced with path finding, or route guidance.

For example, we have the Independent Vehicle Concept that puts a smart vehicle in the existing infrastructure. In-vehicle technology lets the vehicle operate automatically with on-board sensors and computers. The vehicle can use data from roadside systems but does not depend on infrastructure support. We have also the Vehicle Cooperative Concept. This concept lets smart vehicles communicate with each other, although not with the infrastructure. With on-board radar, vision, and other sensors, these equipped vehicles will be able to communicate with each other and coordinate their driving operations, thereby achieving best throughput and safety.

DISCUSSION OF ISSUES

Why this work group? The wide-scale development and deployment of these advanced technologies represents a true revolution in the way we, as a nation, think about transportation. While many aspects of our lives have been made more efficient through the use of advanced technologies, it has taken transportation a long time to catch up. But now it is becoming unavoidable. Vehicles are becoming more and more complex; automation is required. The traffic volume is higher and the vehicle environment is denser; fast and accurate sensing is required to extend human perception. These technologies are being developed and marketed to increase driver safety, performance, and convenience. However, they have yet to be integrated to create a fully intelligent

vehicle that works cooperatively with the driver. The designer of an intelligent vehicle must integrate disparate technologies and systems to create a coherent machine that complements the human driver.

These technologies provide also the intelligent link between travelers, vehicles, and infrastructure. Considering the large number of small and medium businesses (SMBs) in Canada involved in information and electronic technologies, I2S is an appropriate field to develop the Canadian economy related to the automobile sector. There is opportunity to develop intelligent sensor and system suppliers, to see the smooth integration of these technologies into practice and to make a coherent smart vehicle, in cooperation with the US and other large automotive manufacturing centers.

EXPERTS

Experts are invited to join the ATLANTIC network and contribute their knowledge and expertise to the success of Work Group 2.2. Experts will be identified from the following groups:

i. Research agents (i.e. universities or research institutes))
ii. Public agencies (i.e. government departments or carriers)
iii. Private firms (i.e. service and product providers)

A tentative list of experts will be developed from academia and industry.

WORK PLANS

1. Elaborate the Main Discussion Paper Themes

Leader and rapporteur will work with Work Group experts to develop a list of discussion paper topics and to select the highest priority topics for the Work Group discussion paper.

The theme F (Intelligent systems and sensors) of the NCE Auto21 research program will be used as a starting point to identify the scope of the discussion paper. The focus is on the intelligent systems and sensors that will become more prevalent in the upcoming years. While making sure that the discussion paper to be developed take into account any potential overlaps with the other working groups, the three sub-topics of the present Work Group 2.2 are as follows:

I) Control and Monitoring of Vehicle Behaviour: Using systems such as advanced electronics, integrated chassis control systems, active airbag control systems, vehicles will be able to monitor their onboard systems and to adjust for certain situations.

II) Vehicle Guidance, Navigation & Telematics: Collecting and transmitting information enroute, including guidance, traffic conditions and transit schedules. Such systems can decrease traffic incidents, reroute traffic flow and allow for automatic toll collection. (Note this touches on Work Groups 1.1 and 1.3.)

III) Driving Assistance and Automation: Developing driver assistance systems will help reduce accidents, injuries and death and property damage. These systems help drivers make decisions and operate vehicles more effectively. (Note this touches on Work Group 3.2.)

The theme of Intelligent-Vehicle Highway Systems will focus on the potential for services that use wireless (and other) communications between the vehicle and the roadside.

2. Conduct Literature Search & Data Collection

Leader and rapporteur will organize and manage the research work to develop the background material, collect data and conduct analyses with the assistance of students and others for the discussion paper.

For main subtopic and threads, one or more of the following approachs and tasks are envisaged:

i. Survey of state of the art and state of practice
ii. Identify specific ongoing research efforts
iii. Identify best practices and make comparisons of state of the practice to European and American counterparts, and lessons learned
iv. Identify unresolved issues in practice
v. Recommend future R&D needs and plans

3. Prepare Discussion Paper

Leader and rapporteur will draft the discussion paper with input from experts and assistance of students. This will be finalize by the leader and submitted for review by the Core Team. Leader and/or rapporteur will transmit draft discussion paper to the international network partners (via the electronic forum and/or through direct communication) for review and comment to facilitate the benchmarking against European and U.S. experience.

4. Workshop (Fall 2003)

The draft discussion paper will be presented and discussed along with the other Work Group discussion papers to identify future research themes and opportunities.