CARLETON UNIVERSITY

Department of Systems and Computer Engineering

SYSC4700   Telecommunications Engineering   2008

Professor Halim Yanikomeroglu

TERM PROJECT

Ultra-Reliable Wireless Communications for Enhanced Safety in Intelligent Transportation Systems (ITS) with Vehicular Ad Hoc Networks (VANETs)

SUBMIT TWO HARD COPIES OF THE REPORT IN THE ASSIGNMENT BOX BY 4:00 PM, FRIDAY, APRIL 11.

Background

"The term **Intelligent Transportation System (ITS)** refers to efforts to add information and communications technology to transport infrastructure and vehicles in an effort to manage factors that typically are at odds with each other, such as vehicles, loads, and routes to improve safety and reduce vehicle wear, transportation times and fuel consumption." [http://en.wikipedia.org/wiki/Intelligent_Transportation_System]

"A **Vehicular Ad-Hoc Network**, or **VANET**, is a form of mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles and nearby fixed equipment, usually described as roadside equipment.

The main goal of VANET is providing safety and comfort for passengers. To this end a special electronic device will be placed inside each vehicle which will provide Ad-Hoc Network connectivity for the passengers. This network tends to operate without any infra-structure or legacy client and server communication. Each vehicle equipped with VANET device will be a node in the Ad-Hoc network and can receive and relay others messages through the wireless network. Collision warning, road sign alarms and in-place traffic view will give the driver essential tools to decide the best path along the way." [http://en.wikipedia.org/wiki/VANET]

Description

Assume that you are a team of engineers from industry developing a project proposal to be submitted to Transport Canada (http://www.its-sti.gc.ca/en/menu.htm). The goal of the project is to build an ITS network on Highway 401 for road, vehicle, and passenger safety.

The envisaged network will have both wireless and wired communication parts. The wireless part will include vehicle-to-vehicle (V2V) and vehicle-to-roadside (V2R) communications. The wired network will efficiently and timely send the collected roadside information to some data processing centres and will distribute information from those centres back to vehicles. Since safety is the main concern, "ultra-reliable wireless communications" [http://www.merl.com/projects/urwireless] is the target.

As you will see through an internet search, there are a number of technologies being proposed, such as Distributed Antennas Systems (DAS) [http://en.wikipedia.org/wiki/Distributed_Antenna_System] to facilitate V2R communications, and Dedicated Short Range Communications (DSRC) [http://en.wikipedia.org/wiki/Dedicated_Short_Range_Communications] to facilitate V2V communications – just to name a few.

Requirements

You will work in a group of three or four students to develop your company's proposal which will be your report. The report will address the followings, in separate sections if possible, in addition to addressing other issues at your discretion:

- Briefly describe the ITS concept with proper referencing.

- Briefly describe the VANET concept with proper referencing.

- Describe the technology you are proposing for V2V communications. Justify why you chose this particular technology in terms of

    o cost,
    o efficiency,
    o latency,
    o reliability.

    Also identify any potential shortcomings of the proposed technology.

- Describe the technology you are proposing for V2R communications. Justify why you chose this particular technology in terms of

- o cost,
- o efficiency,
- o latency,
- o reliability.

Also identify any potential shortcomings of the proposed technology.

- Comment on the future of the proposed ITS network. What do you envision in

  - o 2018 and
  - o 2028

assuming that the necessary upgrades are made in the network.

Report

It is your responsibility to establish a group of three or four students; two-student or five-student groups will not be accepted. Each group will write one report, and submit it in two hard copies. All group members will get the same mark. It is up to your group to organize the work and allocate tasks to group members. Your group output will be a report which addresses the above issues. Include references (papers, books, internet, etc.), with enough information that they can be looked up by readers.

Do not copy from other sources (especially from internet) or use others' ideas, unless they are acknowledged and properly referenced. Violating this rule amounts to plagiarism, which is a serious instructional offence (see "instructional offences" in the undergraduate calendar, and www.plagiarism.org/articles.html for definitions and examples of plagiarism.). Reference to "other sources" also includes any overlap of your own work in other courses, such as fourth year projects, for example.

The report itself should be no more than 10-15 pages of double-spaced text, plus figures. Your marks will be based on the correct knowledge and persuasiveness revealed in your report, its organization, coherence and clarity, and use of references.