

Demo: Illinois Vehicular Project, Live Data Sampling and Energy-efficient Node Discovery

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Embedded sensors in mobile devices such as cars and smart phones present new opportunities to collect data about an environment. The broad deployment of embedded sensors will lead to wide-spread participatory sensing and enable the generation of large amounts of data. A major challenge is efficiently collecting, storing and sharing the data.

Vehicular networks present several bottlenecks that must be considered. The high mobility of cars causes a continuous migration of data, and possibly its loss, unless replication is used. Additionally, capacity is also a challenge. Using a mobile connection such as 3G or WiMax, information can be uploaded to a central storage and retrieved from the same storage. However, with the increasing number of devices generating data and the rates at which data is generated, the bandwidth requirements will quickly overwhelm the infrastructure, especially considering that those networks are already pushed to the limit to serve existing mobile Internet access. Energy efficiency might not be a primary concern for vehicles, given that when a car is on, it generates enough energy for full-power radio operation. However, a vehicle can be parked for several days, and thus the power for communication would drain the battery. Thus, even in vehicular networks, energy efficient protocols can and sometimes must be used.

Efforts to tackle these challenges led to the design of systems such as Locus [4]. However, it is still not fully understood how these heavy sensing tasks, the peer to peer communication, and the energy efficiency will interact. To answer these questions, among others, we designed and deployed the Illinois Vehicular Testbed (IVT). We instrumented a number of cars with wireless radios (802.11n/g) for car-to-car and car-to-server communication, Bluetooth, GPS receivers and OBD-II receiver to collect on-board diagnostics from the car.

On each car, the 802.11n radio is dedicated to Internet connections by associating to existing access points, while the 802.11g is used for car-to-car communication. The challenge for the latter is that, while running cars can have their radio on the whole time, and therefore it is easy to establish a car-to-car connection, parked cars must use a sleep schedule to prevent excessive battery depletion. An appropriate duty-cycling-based discovery mechanism must be im-

plemented to identify parked cars and establish a connection when possible.

The most relevant projects related to the IVT and that inspired its design are DieselNet [1] which is designed for DTN communications using buses, taking advantage of fixed routes and predictable contacts, CarTel [3], in which a limited number of vehicles is equipped with radios to opportunistically connect to open APs, and BikeNet [2], which also uses opportunistic AP association to upload sensed data.

Our demo will be remotely connected to IVT, where some vehicles will be parked on the roadside, some in garages and some will be driving on campus. The running vehicles will collect data from the different sensors, and make it available to users through our servers. Visitors at the conference will be able to interact with our web interface to see the live and historical data, and the notifications coming from moving vehicles when they pass by and discover cars that are parked on the road or in nearby garages. At the demo site, we will also have an example of the IVT hardware and we will show its functionality and expandability.

Categories and Subject Descriptors

C.2.1 [Network Architecture and Design]: Wireless communication; Store and forward networks; C.0 [GENERAL]: System architectures —*complexity measures, performance measures*

General Terms

Experimentation, Design

Keywords

Vehicular Network, Testbed, DTN, Discovery

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