Sharing Traffic Signal Timing with Vehicles: A Non-DSRC Survey
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Sharing Traffic Signal Timing with Vehicles: A Non-DSRC Survey
Overview

- Comparison of DSRC and non-DSRC in applications for sharing traffic signal timing data with vehicles

- Non-DSRC-based applications for sharing traffic signal timing data
  - In-vehicle cellular application: Audi’s Online Traffic Light Recognition System
  - Smartphone application: Connected Signals’ App “EnLighten”
  - Infrared beacon application: Honda’s Driving Support System

- Stakeholder perspectives on sharing traffic signal timing data

- Conclusions
Performance of DSRC and its Alternatives

- Wi-Fi
- Bluetooth
- NFC
- DSRC
- Infrared Beacon
- Cellular
- Satellite Radio

Range Required to Share Traffic Signal Timing Data (application dependent)

Diagram not to scale, for illustration only
Diagram of Sharing Traffic Signal Timing Data

Traffic Management Entity

Relay Node
In-Vehicle Cellular Application: Audi’s Online Traffic Light Recognition System

- **Deployment Status and Plan**
  - Led by Audi’s team in Germany
  - Initially part of European simTD project
  - First U.S. demonstration at CES 2014
  - Ongoing field trials in Europe
  - No immediate deployment plan in U.S.

- **Claimed Environmental Benefit**
  - CO₂ emission reduction of up to 15%

- **Technical Evaluation**
  - A computation engine combats false positives
  - Good performance with fixed time signals
  - Degraded performance with actuated, adaptive signals or signal preemption

Figure from Audi’s Press Release
Smartphone Application: Connected Signals’ App “EnLighten”

- **Deployment Status and Plan**
  - Service available in over 50 U.S. municipalities
  - Currently being rolled out city by city
  - Facing concerns over driver distraction
  - Also may provide traffic signal timing to OEMs

- **Claimed Environmental Benefit**
  - 5% fuel savings (rudimentary analysis)

- **Technical Evaluation**
  - “Cloud sourcing” scheme for inferring signal status may be developed using position and speed of cell phones, but GPS on mobile devices lacks requisite accuracy
  - Works with fixed time signals only

Figure from Connected Signals
Infrared Beacon Application: Honda’s Driving Support System

- **Deployment Status and Plan**
  - First public demonstration in April 2014 in Japan
  - No known demonstration or deployment plan for the U.S.

- **Claimed Environmental Benefit**
  - Potential emissions reductions being analyzed

- **Technical Evaluation**
  - No need for a centralized computation engine
  - Likely works with all types of signals
  - Line of sight is required between vehicle and beacon

Figure from Honda’s Press Release
Stakeholder Perspectives on Sharing Traffic Signal Timing Data

- **Technology Vendors/Developers**
  - Many automotive OEMs, smartphone developers, and traffic content aggregators are advocates of sharing traffic signal timing data
  - Navigating different data sharing policies in different localities is a major challenge

- **Traffic Signal Device Manufacturers**
  - Most traffic controllers are able to accommodate requests made by these applications for signal status
    - Up to ten times per second

- **Transportation Agencies**
  - Some see a “legal firewall” as necessary to prohibit local caching of signal timing data
    - Others don’t see it as an obstacle to deployment
  - Some are concerned that these apps may cause driver distraction or weaken cybersecurity
Conclusions

- Early demonstrations suggest potential reductions in fuel consumption and vehicle emissions
  - Originally intended for convenience and mobility
  - Support limited types of traffic signals and data types
  - Environmental implications need to be studied further
- Other technologies for sharing traffic signal timing data may also warrant further investigation
  - i.e. FirstNet, camera-based traffic light detection
- Policy and technical challenges remain, but are being addressed
  - Liability, driver distraction, and cybersecurity
- DSRC and non-DSRC technologies may serve as complementary pathways for sharing traffic signal timing data