Dedicated Short Range Communications: Connecting vehicles

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33,561 Traffic Fatalities in 2012

About 7,110,000 results (0.34 seconds)

[PDF] Research Note: 2012 Motor Vehicle Crashes: Overview
www-nrd.nhtsa.dot.gov/.../81... United States Department of Transportation
The nation lost 33,561 people in crashes on roadways during 2012, compared...
Overall Statistics. In 2012, 33,561 people died in motor vehicle traffic crashes.

33561 People Killed in Traffic on American Streets Last Year
usa.streetsblog.org/.../its-official-33561-people-killed-in-traffic-on-ameri...
Nov 14, 2013 - The official 2012 death toll is out for our nation’s poorly-designed, ...
traffic injuries on the nation’s roadways claimed the lives of 33,561 people.

NHTSA Data Confirms Traffic Fatalities Increased In 2012 ...
Nov 14, 2013 - NHTSA Data Confirms Traffic Fatalities Increased In 2012 ...
System (FARS) data indicating that highway deaths increased to 33,561 in 2012, ...
What if …

we could use **wireless communication**
to make driving safer?

**DSRC**
Dedicated Short Range Communication

**80%**

US DOT estimates DSRC can address 80% of crashes involving non-impaired drivers
DSRC Outline

• What is it?
• What is it good for?
• How does it work?
• What’s hard about this?
• What happens next?
What is DSRC?

• Ad hoc networking to and from vehicles
  – V2X where X = {vehicle, roadside infrastructure, phone, bicycle, train, pedestrian …}

• Part of the Intelligent Transportation System (ITS)

• Key for US DOT Connected Vehicle program
What is DSRC Good For?

• Saving Lives
• Preventing or reducing:
  – Injuries
  – Property destruction
  – Time lost in traffic
  – Fuel consumption/Greenhouse gas emissions
• Enabling mobile commerce
• Informing drivers
• Creating sandbox for innovation …
DSRC V2V Safety Concept

- Concept: each vehicle sends Basic Safety Messages frequently.
- Receiving vehicles assess collision threats.
- Threat: Warn driver or take control of car.
Example collision scenarios

• All enabled by exchange of BSMs
• Receiver apps not standard
• Innovative uses of BSM encouraged

Emergency Electronic Brake Lights (EEBL)
Forward Collision Warning (FCW)
Left Turn Assist (LTA)
Intersection Movement Assist (IMA)
Blind Spot / Lane Change Warning (BSW / LCW)
Do Not Pass Warning (DNPW)

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Roadside use case: Work Zone Warning

In-Vehicle Display and Annunciation

RSU = Roadside Unit
V2I Safety Use Case: Emergency Signal Preemption

Preempt Transaction
1. DSRC OBE-to-RSE: Vehicle Host Preemption Request
2. DSRC RSE-to-OBE: ACK
3. Emergency Vehicle Host Displays Preempt-ACK within vehicle

OBU = On Board Unit, RSU = Roadside Unit
How does DSRC Work?

- Necessary for interoperability
- Most standards mature

DSRC System

Example of DSRC Prototype System
Many suppliers are in this space
Recent move to allow unlicensed sharing discussed below
What is hard about DSRC?

Mobility:
- Testing shows 802.11p capable of dependable communication over ~300 meters @ 20 dBm
Scalability

Basic question: will all this still work here?
Distributed Adaptive Control

Each vehicle computes its message rate $r_i(t)$ adaptively based on channel load

Algorithm Goals: controlled load, convergence, fairness
Adaptive Algorithm: LIMERIC

- Linear Message Rate Integrated Controller
- Toyota ITC idea
- Currently under evaluation in US and Europe

Mathematically provable behavior
Demonstrated via simulation
Verified by radio implementation

Security and Privacy

• Goals:
  – Receiver needs to trust information it gets
  – We need to preserve privacy of drivers
  – Costs need to be controlled

• Two principal areas:
  – Per-message security
  – Security Infrastructure
Per-Message Security

- IEEE 1609.2 standard defines how to authenticate and how to encrypt
- Authentication proves
  - Sender was authorized
  - Content was not changed
- No permanent identifiers are included
Security Infrastructure

Get/Renew credentials?
Detect misbehavior?
Remove bad actors?

Certificate Authority (CA)

New Certificates
Certificate Revocation Lists

Misbehavior Reports

What medium?
Status of DSRC Deployment

- 10+ years of research (US DOT, industry)
- Standards are mature
- Aug. 2012-Aug. 2013 Model deployment

- Testing collision avoidance
- ~3000 DSRC equipped vehicles
- Includes cars, trucks, buses, motorcycles
- > 20 infrastructure locations
- 100s GB data collected
- > 10 TB video collected
What happens next for DSRC?

- Feb. 3, 2014: NHTSA plan to require DSRC
  - Regulatory process is starting

- US DOT expanding test beds and field trials:
  - Michigan, Florida, New York, California
  - [http://www.its.dot.gov/testbed.htm](http://www.its.dot.gov/testbed.htm)

- Engagement from suppliers
- OEMs ramping development
- Technical challenges remaining:
  - Spectrum Sharing
  - Global harmonization
  - Protocol evolution
  - Automated control
Conclusions

• DSRC has great potential to make driving safer: 33,561
• DSRC can enable many other services, including automated driving
• Technology is relatively mature
• US DOT planning to require DSRC
• Remaining challenges include:
  – Congestion Control (Scalability)
  – Security
  – Spectrum Sharing