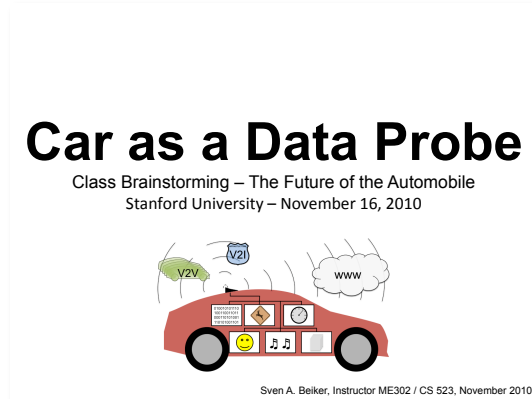


Car as a Data Probe

Notes from Stanford seminar class (unstructured, unedited)
 “The Future of the Automobile”

Sven Beiker, Lecturer, Stanford University
 November 16, 2010

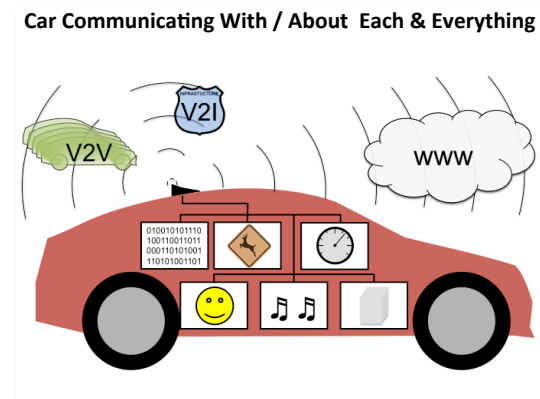
Introductory Presentation by Sven Beiker



Car as a Data Probe
 Class Brainstorming – The Future of the Automobile
 Stanford University – November 16, 2010

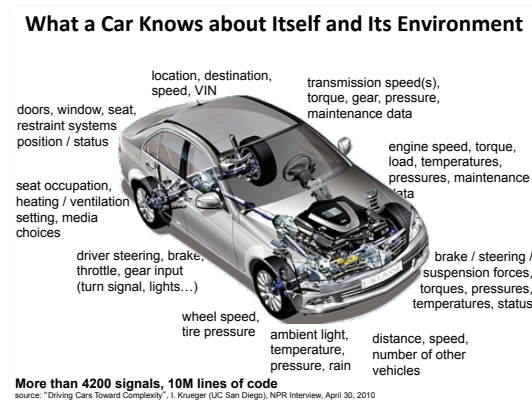
A red car is shown with various icons representing data points: a green cloud labeled 'V2V', a blue shield labeled 'V2I', a white cloud labeled 'www', a yellow smiley face, a musical note, and a clock. The car's dashboard shows a speedometer and a warning light.

Sven A. Beiker, Instructor ME302 / CS 523, November 2010



Car Communicating With / About Each & Everything

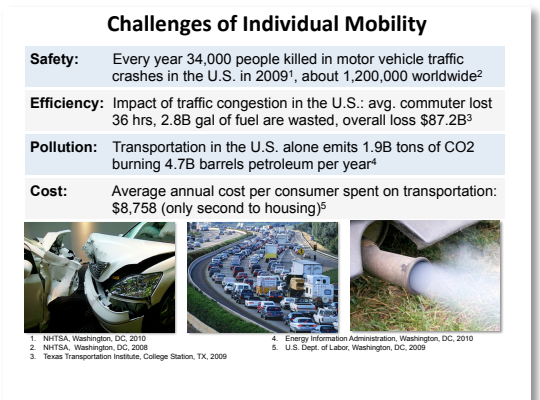
A red car is shown with various icons representing data points: a green cloud labeled 'V2V', a blue shield labeled 'V2I', a white cloud labeled 'www', a yellow smiley face, a musical note, and a clock. The car's dashboard shows a speedometer and a warning light. A binary code string is visible on the car's side.



What a Car Knows about Itself and Its Environment

location, destination, speed, VIN
 transmission speed(s), torque, gear, pressure, maintenance data
 doors, window, seat, restraint systems position / status
 engine speed, torque, load, temperatures, pressures, maintenance data
 seat occupation, heating / ventilation setting, media choices
 driver steering, brake, throttle, gear input (turn signal, lights...)
 brake / steering / suspension forces, torques, pressures, temperatures, status
 wheel speed, tire pressure
 ambient light, temperature, pressure, rain
 distance, speed, number of other vehicles

More than 4200 signals, 10M lines of code
 source: "Driving Cars Toward Complexity", I. Krueger (UC San Diego), NPR interview, April 30, 2010



Challenges of Individual Mobility

Safety: Every year 34,000 people killed in motor vehicle traffic crashes in the U.S. in 2009¹, about 1,200,000 worldwide²

Efficiency: Impact of traffic congestion in the U.S.: avg. commuter lost 36 hrs, 2.8B gal of fuel are wasted, overall loss \$87.2B³

Pollution: Transportation in the U.S. alone emits 1.9B tons of CO2 burning 4.7B barrels petroleum per year⁴

Cost: Average annual cost per consumer spent on transportation: \$8,758 (only second to housing)⁵

1. NHTSA, Washington, DC, 2010
 2. NHTSA, Washington, DC, 2008
 3. Texas Transportation Institute, College Station, TX, 2009
 4. Energy Information Administration, Washington, DC, 2010
 5. U.S. Dept. of Labor, Washington, DC, 2009

Safety Applications for Car as Data Probe

- Share velocity / course among vehicles to avoid accidents
- Identify dangerous driving situations (outside temperature, tire pressure...)
- Make space for emergency vehicles

Efficiency Applications for Car as Data Probe

- Real-time traffic information
- Real-time congestion pricing
 - o Make variable price on GPS routing available
 - o Include environmental impact
- Dynamic routing (according to traffic situation)
- Mainframe network monitoring to identify / resolve incidents
- Traffic mast control to provide driving instructions / recommendations
- Get time slot allocated for trip
- Consider vehicle specifications / performance for traffic control
- Predict traffic flow for traffic lights (oncoming vehicles)

Environmental Applications for Car as Data Probe

- Adjust engines on a “high ozone day”
- Provide more accurate / specific data to driver for maintenance

Miscellaneous Applications for Car as Data Probe

- Provide data to manufacture for product improvement
- Real-time failure prediction (across vehicles of one make / brand)
- Driver intelligence to let driver know what is going on (standardized across brands)
- Identify driver behavior / intent and adapt vehicle
- Monitor driving behavior for insurance, education, taxation

Concerns Regarding Car as Data Probe

- What to show on dashboard
- Privacy
- Be careful what you wish for