Connectivity: Driving Vehicle Technology to 2020 and Beyond

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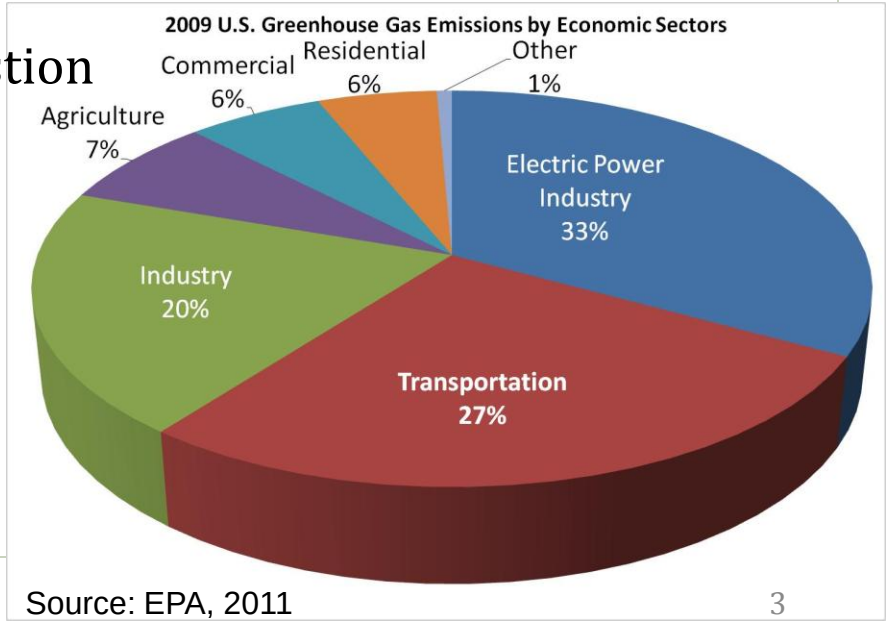
The Transportation Picture (Now and Then)

- U.S. Population (U.S. Census Bureau)
  - 2010 : 308 million +
  - 2020 : 341 million +

- Number of Vehicles on U.S. highways
  - 2008 (most recent): 255 million+
  - 2020 : 300 million+

Today's Transportation Challenges

- Crashes (2009)
  - 5,500,000 crashes/year
  - 33,808 deaths/year
  - Leading cause of death for ages 3 to 34
- Congestion[1]
  - 4.8 billion hours of travel delays
  - $115 billion cost of urban congestion
- Pollutants and Emission[1]
  - 3.9 billion gallons of wasted fuel
  - Greenhouse Gases

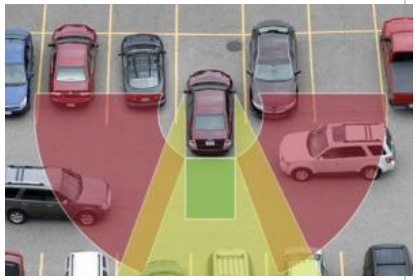


Source: EPA, 2011

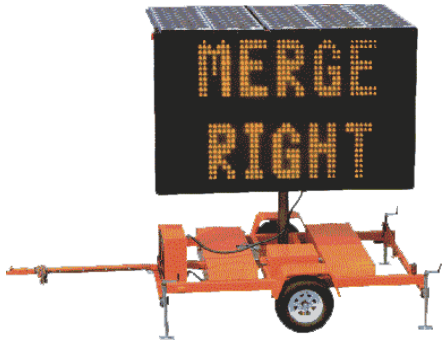
[1]TTI's 2010 Urban Mobility Report

Today's Technology

- Safety
  - Traditional sensors
    - Radar
    - Infrared
    - Sonic
    - Optical



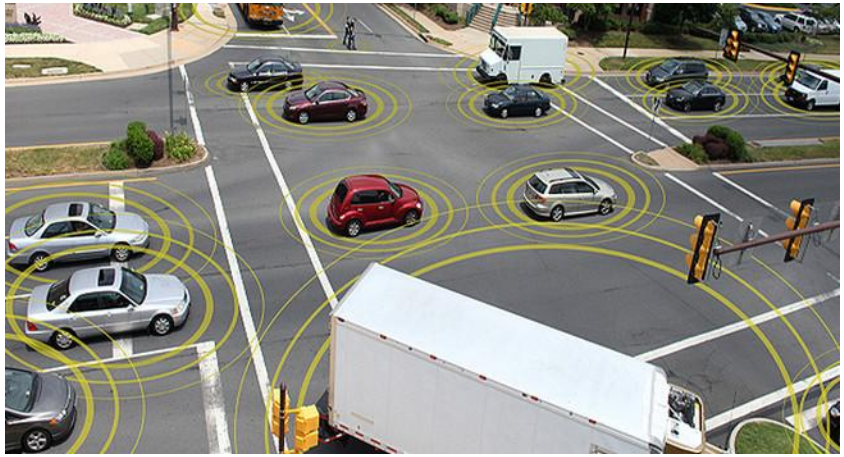
- Mobility
  - Advanced Traveler information systems
  - Highway advisory radio
  - Synchronized and adaptive traffic signals
  - Variable message signs indicating traffic congestion



- Limitations
  - Isolated view
    - Limited Field of View
    - Limited data fusion or connectivity with other safety systems

Tomorrow's Technology Solutions

- Vehicle Connectivity
  - Safety Applications
    - Dedicated Short Range Communications (DSRC) 5.9 GHz
      - Augment or replace onboard sensors
      - Low latency
      - ~ 300 m range
  - Mobility/Environmental (Non-safety applications)
    - Other wireless technologies (e.g., WiFi, WiMAX, 3G)
      - Longer range
      - Higher latency
      - ~ 30 miles
  - Exchange of key information
    - Position, heading, speed
    - Time stamp, Path history
    - Vehicle size
    - Authentication certificate



Tomorrow's Technology Solutions

- Safety Applications
  - Cooperative Forward Collision Warning (CFCW)/Adaptive Cruise Control (ACC)
  - Emergency Electronic Brake Light (EEBL)
  - Blind Spot Warning (BSW)/Lane Change Warning (LCW)
  - Control Loss Warning (CLW)
  - Intersection Movement Assist (IMA)
  - Wrong Way Driver Warning (WWDW)
  - Do Not Pass Warning (DNPW)
  - Left Turn Assist
  - Cooperative Stop Sign Violation Warning (CSSVW)
  - Cooperative Traffic Signal Violation Warning (CTSVW)

Tomorrow's Technology Solutions

- Cooperative Forward Collision Warning (CFCW)/Adaptive Cruise Control (ACC)

Naturalistic driving video of tractor trailer rapidly approaching stopped traffic. (Participant protections prevent public release of video)

Tomorrow's Technology Solutions

- Emergency Electronic Brake Light (EEBL)

Naturalistic driving video of tractor trailer rapidly approaching slowed traffic. (Participant protections prevent public release of video)

Tomorrow's Technology Solutions

- Blind Spot Warning (BSW)/Lane Change Warning (LCW)

Naturalistic driving video of motor home rapidly encroaching into traffic from left-hand merge lane.
(Participant protections prevent public release of video)

Tomorrow's Technology Solutions

- Blind Spot Warning (BSW)/Lane Change Warning (LCW)

Naturalistic driving video of tractor trailer merging into right lane and fails to see adjacent vehicle in blind spot.
(Participant protections prevent public release of video)

Tomorrow's Technology Solutions

- Control Loss Warning (CLW)

Naturalistic driving video of light vehicle losing control around sharp turn on a two-lane road.
(Participant protections prevent public release of video)

Tomorrow's Technology Solutions

- Mobility Applications
  - Multi-modal intelligent traffic signal system
  - Intelligent Dynamic Transit Operations
  - Freight Advanced Traveler Information System
  - Enable Advanced Traveler Information System
  - Intelligent Network Flow Optimization
  - Response Emergency Staging Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)

Tomorrow's Technology Solutions

- Advanced traveler information system that integrates multi-source, multi-modal data

Naturalistic driving video of light vehicle passing tractor trailer on right side and runs into work zone barrels.
(Participant protections prevent public release of video)

Vision of Vehicle Technology in 2020

- Vehicle Connectivity will foster:
  - Truly Integrated Safety Systems
    - Same data used for numerous safety applications
  - Advanced Driver Vehicle Interfaces
    - Integrated displays to spatially relate information (360 degrees)
    - Increased data management (warnings, advisories, information)
    - Flexible, transparent materials (e.g., OLEDs)
  - Automation
    - Evasive maneuvering
    - Convoying
    - Auto Parking (beyond park assist)


Thank You!!
Questions?
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