Deploying Vehicle-Based Technologies

Considerations and Lessons Learned

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Virginia Tech Transportation Institute

Virginia Tech Transportation Institute (VTTI)

- Located near Virginia Tech in Blacksburg, Virginia
- Home to the Virginia Smart Road facility
- Virginia Tech's largest research enterprise
- 300 staff members and students
- Nation's 2nd largest Transportation Research Institute
- Approx. $30M Research funding (FY 2010)

VTTI Capabilities and Resources

- Expertise and experience
  - Driving data acquisition
  - Data storage, handling, analysis
- Facilities
  - Virginia Smart Road
  - The Instrumented City (Blacksburg)
  - Crash simulation – Injury Biomechanics
  - National Tire Research Center – Virginia International Raceway
  - Truck simulator
  - Vehicle fleet including trucks, buses, vans, pickups, SUVs, cars, motorcycle(s)

Data collection system box under passenger's seat

Data collection system box

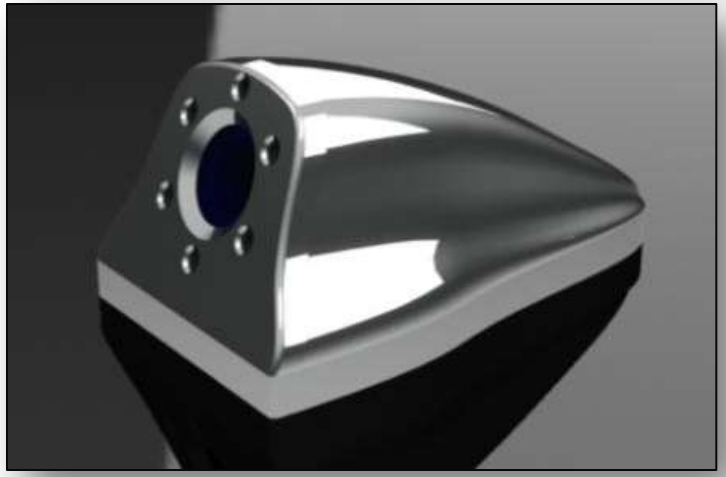
Front VORAD

Rearward Camera

Face & Forward Cameras

Camera Vision Systems

- Focus Areas
  - Lane change behavior
  - Driver spatial awareness
  - Benefit of IVS technology
- Methods
  - 12 commercial drivers
  - 1 fleet - 1terminal
  - 6 instrumented trucks
    - Forward- and side-mounted radar
    - 8 camera views



Drowsy Driver Warning System

Research Objective

Collect data that can be used to evaluate the effectiveness and operational capabilities, limitations, and characteristics of a drowsiness monitor.

AVLS Installation

- Component mounting
  - User interface
  - Main Unit
  - Ancillary
    - Antennas
- Connections - routing
  - Power
  - User interface / display
  - Antennas
  - Vehicle network
  - On-board systems

Equipment Installation Considerations

- Connections!, connections!, connections!
- Equipment sharing
  - Leave wiring, antennas, etc.
  - Share more expensive components
- Interference from other equipment
  - Radios
- Beware the parasitic loads
- Antenna placement

Communication Considerations - Data

- Type
  - GPRS
  - SMS
  - 4G LTE
  - Satellite
  - Bluetooth
- Adequate bandwidth
- Data transfer costs
- Automatic signal reacquisition

Communication Considerations - GPS

- Reliability
  - Blocking (trees, buildings, topography)
  - Last known good location
  - Interference (LightSquared)
- Augmentation
  - WAAS
  - DOT efforts
  - Obstacle warning?
- Accuracy notification

Integration with Other On-Board Systems

- Connections
- Signal
- Data format
- Speed
- Resolution
- Matching or adequate data resolution
- “Plug and Play” standards (Clear Roads, e.g.)
- Vehicle network (CAN bus, J1939)

AVLS/Human Interaction – The Good

- Improved safety
  - Location, movement
  - Fatigue prevention
- Record keeping
  - Less paperwork
  - Improved reporting accuracy
- Investment and involvement
- Less concern of damage claims

AVLS/Human Interaction – The Bad

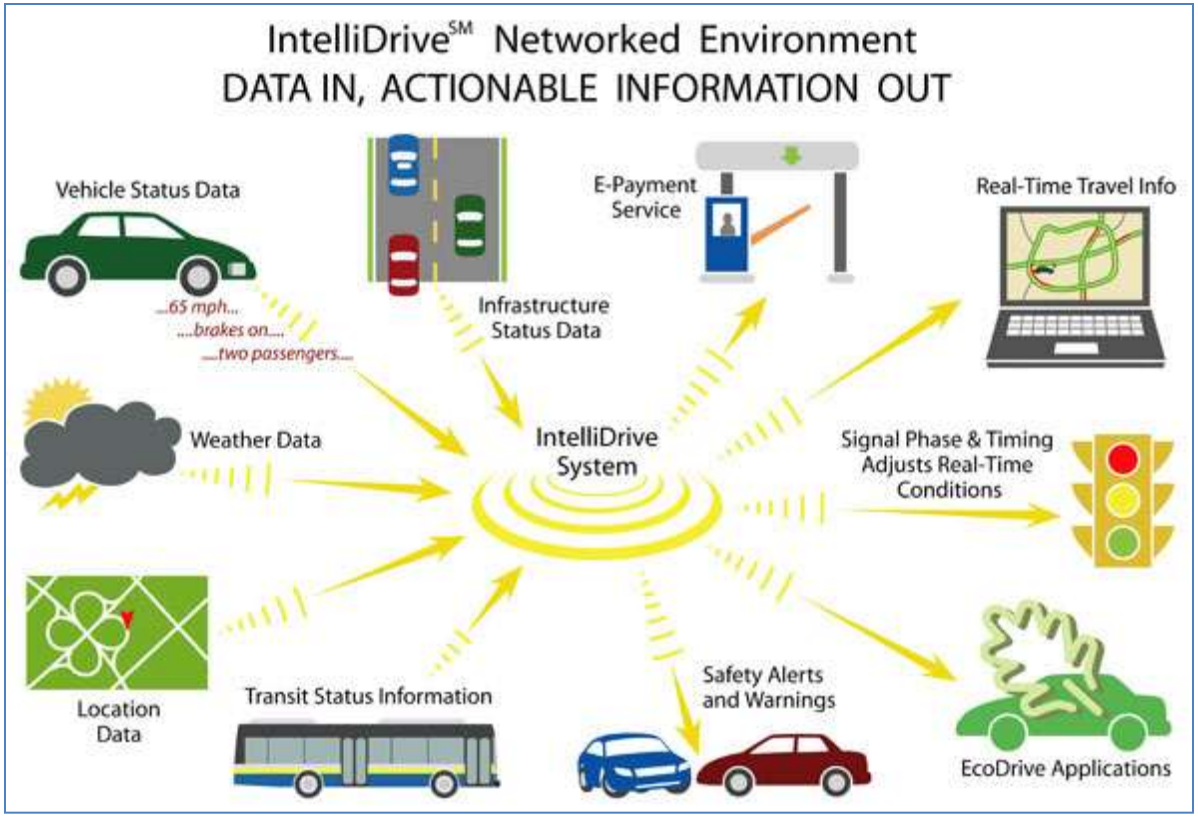
- Distraction – Eyes-Off-Road
- Poor software interface issues
- Perception of “Big Brother”
- Poor training and frustration with system
- Dependability and operator’s reliance upon it

AVLS/Human Interaction – Recommendations

- Involve the operators up front
- Provide exceptional training
  - Operators
  - Supervisors
- Consider how and when the system will be used
- Good software interface
  - Touchscreen
  - Voice recognition
- Interface mounting and speed lockout
- Consider Eyes-Off-Road

Future Considerations - Connected Vehicle

"A multimodal initiative that aims to enable safe, interoperable networked wireless communications among vehicles, the infrastructure, and passengers'* personal communications devices."



* And others

Reference: www.intellidriveusa.org

Connected Vehicle Applications

- Safety
  - Collision warning
  - Traffic signal violation warning
  - Emergency notification
- Mobility
  - Adaptive traffic signals
  - Intermodal transfers
  - Event and emergency planning/response
  - Parking location assistance
- Environmental
  - Eco-routing
  - Multi-modal routing
  - Adaptive roadway lighting
  - Smart intersections

Future Considerations - Connected Vehicle

- Data sources
  - Vehicles as mobile probes
    - 2012 stability control required on passenger vehicles
    - Maintenance vehicles (speed, air temp, fuel usage)
  - Roadside sources (weather, pavement, signals)
    - NCAR weather algorithms
- Integration with MDSS
- Improvement of vehicle location technology

Future - Optimized Winter Maintenance

- Use of Connected Vehicle network and data allows more effective and efficient deployment of pre-treatment, treatment, and plowing operations
- Local weather information from Connected Vehicle network
  - From vehicles:
    - Temperature, barometric pressure, precipitation sensors, head lights
    - Activation of ABS, Stability control, traction control
  - From roadside equipment:
    - Pavement temperatures, humidity, etc.
- From on-board equipment in maintenance vehicles
  - Application rates
  - GPS, Time