Improving Pedestrian and Cyclist Safety with Automated and Connected Vehicle Technology

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Agenda

- Background
  - Vulnerable Road User Safety
  - Emerging Technologies

- SwRI’s Solution: A Cooperative Situational Awareness System
  - Conceptual Overview
  - Underlying Steps
  - Prototypes and Pilot Deployment

- Next Steps
Vulnerable Road User Safety (or lack thereof)

- Recent increase in incidents
  - Pedestrian: 10%
  - Cyclists: 1.5%
  - 25-year high

- Persistent problem with no end in sight
Emerging Technology: Automated Vehicles

- **Capabilities:**
  - Object detection
  - Collision avoidance

- **Limitations:**
  - Range
  - Field-of-view

- **Long time horizon for full automation**
Emerging Technology: Connected Vehicles and Infrastructure

- Share safety and mobility information
  - Vehicle-to-vehicle (V2V)
  - Vehicle-to-infrastructure (V2I)
  - Vehicle-to-everything (V2X)

- Shorter time horizon for deployment
SwRI’s Solution: A Cooperative Situational Awareness System

Cooperative Vehicle-Infrastructure Situational Awareness
High-Traffic Intersections, Work Zone & School Zones

LEGEND
1. Static situational awareness system detects pedestrians, bicyclists, & vehicles
2. Static system transmits situational awareness message & SPAT/MAP to surrounding vehicles
3. Vehicles contribute to the collective model of the area
4. Applicable for dangerous intersections, school zones, and construction work zones

Situational Awareness System

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Identify Objects of Interest

- Leverage traditional vehicle- and infrastructure-based sensors
  - Cameras
  - Radar
  - Lidar

- Detect and classify relevant objects and events
  - Pedestrians and pedalcyclists
  - Pedestrian or pedalcyclist in crosswalk
Combine and Map Data

- Fuse object data from both vehicles and infrastructure sensors
- Identify zones of interest
- Generate warnings or alerts
Distribute Actionable Information

- Broadcast:
  - Warnings / alerts
  - Fused object map

- Incorporate into “basic infrastructure message (BIM)”
Prototype Vehicle System

- Detect relevant objects
- Share object information with nearby vehicles
Prototype Infrastructure System

- Edge Computing
- Infrastructure Sensors (cameras)
- Comms & GPS Antennae
- Ruggedized Enclosure
- Communications Hardware
San Antonio Pilot Deployment and Analysis

- Dynamic urban intersection
  - Signalized
  - Multi-lane
  - Heavy pedestrian traffic
  - Bus traffic

- Ideal conditions
  - Daytime
  - Clear, calm, dry
Further Analyses

- Additional object classification
  - Cyclists
  - Vehicles

- Fusion of vehicle and infrastructure data

- Degraded operation testing and analysis
Summary

- Vulnerable road user safety is still a significant problem.

- SwRI has developed a cooperative situational awareness system that could mitigate this problem.

- Initial testing and analysis shows promise, but more work to be done!
Thank You!

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