Intersection Collision Avoidance

PURPOSE

Intersection movement assistance and collision warning systems are designed to detect and warn responders of approaching traffic at high-speed intersections using Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) sensors.

BENEFIT

Reducing the risk of collisions at intersections, especially ones which are blind, will result in life safety, economic, and operational readiness improvements for the responder community and general public.

USE CASE

A law enforcement officer on routine patrol receives a collision alert message while approaching a busy intersection with a partially obstructed view. Despite having the right of way, the officer is warned of an approaching vehicle that is likely to run the red light due to its speed, direction of travel, and observed driving behaviors. The officer reacts by slowing down to avoid the potential catastrophic broadside collision.

Research Finding: The timing of warnings/alerts to drivers is the lynchpin in this technology. A May 2016 NHTSA Report, Commercial Connected Vehicle Test Procedure Development and Test Results – Intersection Movement Assist, showed the feasibility of the technology, but that more work needs to be done, especially to modify warning messages after corrective action is taken by a driver.

NHTSA estimates that a connected vehicle safety application that helps drivers safely negotiate intersections could help prevent 41 to 55 percent of intersection crashes. (USDOT, ITS JPO, 2016)

CV Technologies which may help prevent intersection collisions:
- Signalized Left Turn Assist
- Red Light Violation Warning
- Stop Sign Violation Warning
- Vehicle to Vehicle Communication
- Signal Preemption

Players: All Responders and Public
Priority: High
Integration: Telemetry and in-vehicle sensors can be leveraged with Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), and Vehicle to Pedestrian (V2P) alert and warning systems to mitigate the risk of responder vs. responder and responder vs. non-responder vehicle collisions.

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Emergency Vehicle Traffic Signal Preemption

PURPOSE
Connected vehicle traffic signal preemption systems are designed to transfer the normal operation of traffic signals to provide multiple emergency vehicles with prioritized access at intersections to allow safe passage and to mitigate the risk of collisions. These enhanced systems leverage Vehicle to Infrastructure (V2I) capabilities.

BENEFIT
Traffic signal preemption systems will expedite emergency vehicle response to an incident and reduce the risk of loss of life, injuries, and property damage associated with intersection collisions involving emergency vehicles. These collisions are common risks when operating vehicles under emergency conditions.

USE CASE
An ambulance is responding to a possible cardiac arrest involving a child at a local swimming pool. A fire engine company staffed with paramedics is also responding to the incident. Through Connected Vehicle technologies, traffic management systems detect the approaching emergency vehicles traveling with their emergency equipment activated. Traffic signals are automatically prompted to provide the emergency vehicles with the right-of-way. This expedites their safe response to the life-threatening emergency.

CASE STUDY
Maricopa County, Arizona, leveraging a CV testbed, conducted an Emergency Vehicle Preemption (EVP) study to examine the challenges and efficiencies of various EVP technologies. The study found that CV technology can engage with multiple emergency vehicles approaching a controlled intersection, evaluate multiple criteria, prioritize vehicle access through the intersection, and provide direction back to emergency vehicle operators. Source: Maricopa Association of Governments (MAG) Emergency Vehicle Preemption State of the Practice Study (July 2016)

FOR MORE INFORMATION

During 2011, public safety related motor vehicle crashes resulted in **34 fatalities** involving ambulances, **14 fatalities** involving fire equipment, and **83 fatalities** involving law enforcement vehicles.

INTERSECTIONS are the most common location across all disciplines for public safety motor vehicle crashes.


Use of emergency vehicle signal preemption in Fairfax County, VA resulted in a 30 to 45 second reduction in time of transit through high traffic density intersections. (Traffic Signal Preemption for Emergency Vehicles, A Cross-Cutting Study, FHWA January 2006)

Use of emergency vehicle signal preemption in Plano, TX, has reduced intersection crashes from 2.3 per year to less than 1 every five years. (Traffic Signal Preemption for Emergency Vehicles, A Cross-Cutting Study, FHWA January 2006)
Work Zone, Incident Scene and Traffic Safety Alerts

**PURPOSE**
Leveraging V2X systems and Connected Vehicles provides drivers and emergency response personnel with warnings for work zone and incident scene incursions. Audible warnings to those working at an incident scene can provide notice to take a protective position in order to limit the risk of deaths, injuries, and property damage. Connected Vehicle drivers receive work zone and traffic incident alerts to facilitate a safe and slowed approach where responders and transportation workers are present.

The use of CV technology to alert and direct traffic approaching roadside or roadway incidents will contribute to saving lives, reducing injuries, and protecting property. These compelling traffic safety incident management objectives are detailed in standards such as the Standard for Traffic Control Incident Management Professional Qualifications (NFPA 1091), the Standard on Fire Department Occupational Safety and Health Program (NFPA 1500), and the USDOT Manual on Uniform Traffic Control Devices (advance warning, transition, activity, and termination areas).

**BENEFIT**
Work Zone, Incident Scene and Traffic Safety alerts reduce incursions by inattentive drivers which result in deaths, injuries, and property damage, warn emergency personnel and transportation workers who are unprotected when an incursion is eminent, and mitigate the risk of secondary and tertiary incidents that require additional resources to manage and resolve.


**USE CASE**
A fatal multi-vehicle interstate traffic accident is being worked by a team of Connected Responders (police, fire, EMS, traffic management, and towing/recovery services). Approaching vehicles are warned of the incident via Connected Vehicle alerts and messages. An approaching vehicle operated by an impaired driver begins to drift out of the travel lane and onto the shoulder without braking. A collision with Connected Responder vehicles and personnel out of their vehicles is imminent. An audible warning is broadcast to all responders on the scene, allowing them a few seconds to take protective action. The alarms and warnings limit the impact of the collision to property damage with no additional injuries or loss of life.

**FOR MORE INFORMATION**

This publication is the product of a cooperative agreement between RYLEX PSC and ITS-America.
Road Weather Alerts and Warnings

PURPOSE
Road weather alert and warning systems will notify drivers about unsafe conditions and roadway closures due to weather-related events through Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) transmitted messages.

BENEFIT
Reducing the risk of collisions due to vehicles losing control or operating in impeded/inhibited sight situations due to weather will result in life safety, economic, and operational readiness improvements for the responder community and general public.

Strategic Decision Support: According to the FHWA, roadway weather warnings will not only provide critical information to emergency responders to adjust driving in response to potentially hazardous roadway conditions, but can also provide strategic decision making support for best routes to incidents for the responders, avoiding unsafe areas or roadways that may become congested or experience slower traffic due to roadway conditions.

USE CASE
Under moderate traffic conditions, the public, commercial vehicles, and connected responders are travelling on a mountainous rural interstate in late October. The risks of black ice are evaluated and updated based on Connected Vehicle technology transmitting from passing vehicles. Connected Vehicles broadcast real-time alerts and warnings that cause other motorists to adjust their speed and expand their following distances. These alerts reduce the risks of single vehicle and chain reaction collision on the foggy mountain pass.

Roadway Weather Warnings would incorporate the use of a Vehicle Data Translator (VDT) which would gather data from a variety of internal and external sources and sensors in and on a vehicle to derive roadway and weather conditions. Examples of potential sources include: headlights and windshield wiper usage, ambient external temperature, activation of stability and traction control, differential wheel speed, etc.

FOR MORE INFORMATION
Wearable Technology for Connected Responders

PURPOSE
Integration of wearable technology with Connected Vehicle technology can provide additional data collection points for information exchange and provide mechanisms for communicating information to the emergency responder within the vehicle and while outside the vehicle.

BENEFIT
Wearable technology allows emergency responders to receive mission-related information while allowing the responder to work in a hands-free environment and collecting a wide variety of mission-related information, which can be transmitted in real time to other responders and command centers or be viewed forensically at a future date.

USE CASE
An emergency responder is checking on crash victims on the scene of a multi-vehicle crash with injuries, occupying two lanes of a four lane highway. The responder is carrying a land mobile radio and wearing a smart watch that broadcasts his location as he moves through the crash scene on foot. Using V2P technology the system detects that an approaching vehicle may encroach upon the crash scene with a high probability for a secondary collision. The CV system sends an audible alert to the emergency responder via his land mobile radio system and an audible and sensory alert via his smart watch. In the event that the responder is struck despite taking evasive action, data from an accelerometer, gyroscope (determining if the responder is “down”), impact-sensing clothing, and bio/physical monitoring is gathered and transmitted to other responding personnel as they near the scene.

CASE STUDY
While there has been no specific integration between wearable and CV technologies for emergency responders, there have been recent tests and studies of wearable technologies for the responder community. The 2015 Urban Shield exercise in Northern California, which teamed law enforcement tactical teams with firefighters and EMS, was the platform for testing a new wearable smart gateway. The gateway provided capability for real-time video streaming and personal health diagnostics.

FOR MORE INFORMATION

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QUICK LOOK: CONNECTED RESPONDER BENEFITS

Connected Vehicle Reference Implementation Architecture (CVRIA)

PURPOSE
A user friendly online resource for Connected Vehicle (CV) technical standards, applications, and web-based training designed for technical and non-technical audiences.

OVERVIEW
This ITS Joint Program Office sponsored web based library provides practitioners and technologists with a deeper understanding of Connected Vehicle technical and integration requirements. The CVRIA “one stop shop” is an essential forum to learn and share Connected Vehicle (CV) information. CVRIA is an objective source for technical guidance on Connected Vehicle networks, components, and communication protocols for responders and the information technology professionals that support them need. The CVRIA provides CV enterprise, functional, physical, and communications views of this important advancement in public and first responder safety.

INNOVATION SPRINGBOARD
A working knowledge of the CVRIA provides end-users with the tools necessary to leverage emerging CV capabilities and to advance new applications based on clearly defined standards. Educated users of CV technologies may accelerate the design, testing, and deployment of new applications based on a working knowledge of CV components and communications protocols. Practical and technical innovations are expected to emerge from the broad community of potential users of the technology.

FOR MORE INFORMATION
For more information on the CVRIA and to view CVRIA documentation visit: www.iteris.com/cvria/; White House Fact Sheet: Encouraging the Safe and Responsible Deployment of Automated Vehicles, September 19, 2016.

Players: All Responders, Information Technology Professionals, Fleet Managers, and Application Developers
Priority: High

What is a Reference Implementation Architecture?
A Reference Implementation Architecture is a primary means to address technology stakeholder concerns and requirements. It results from collaboration between stakeholders (practitioners) and designers (engineers) to create common language definitions and deployment concepts and approaches and often includes Concept of Operations and System Requirements considerations.

10 million crashes in 2015
4.4 million injuries and over 38,000 deaths
94% of accidents are due to human error (ITERIS, Connected Vehicles, 2016)

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