Vehicle-to-Railway (V2R) Technology Development: Issues & Considerations

TRAINFO

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TRAINFO

Real-time railroad crossing information

✓ We produce real-time railroad crossing blockage data.

✓ We measure traffic impacts caused by blocked railroad crossings.

✓ We provide ITS solutions to mitigate traffic impacts.

Proprietary Sensors

Interactive Dashboards

Live Maps

Roadside Signs

Mobile Apps

TMC Integration

BACKGROUND

Rail Safety Improvement Program (RSIP) Research

FRA Workshop & Project Participation

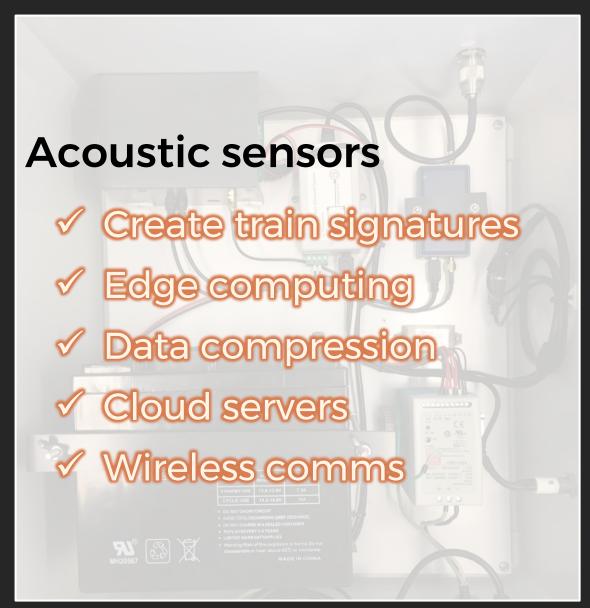**National Research Council (NRC) Projects**

TRANSPORT CANADA
RAIL SAFETY IMPROVEMENT PROGRAM

- Testing train detection technologies
- Testing communication & power technologies
- Testing warning technologies

- ✓ Off rail property
- ✓ Accurate
- ✓ Low-cost
- ✓ Low-maintenance
- ✓ All weather conditions
- ✓ All light conditions
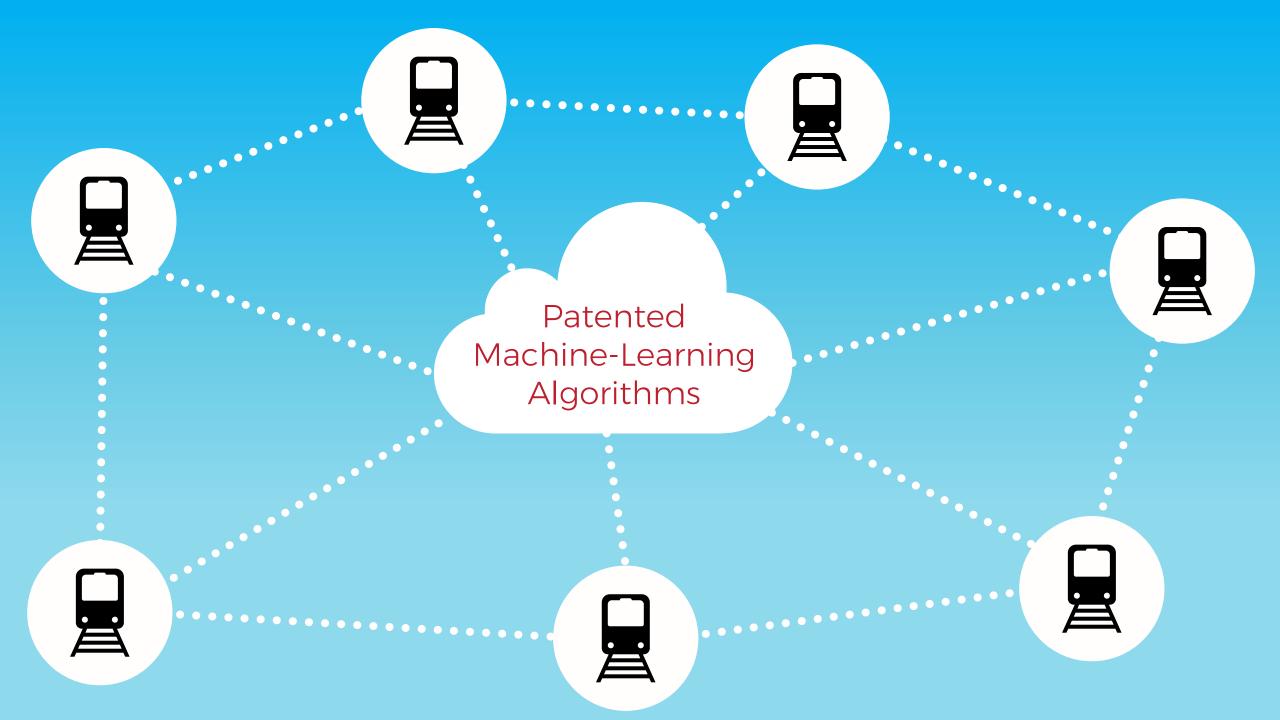- ✓ Easy installation & calibration
- ✓ Reliable

Train Detection Sensor

Acoustic sensors

- ✓ Create train signatures
- ✓ Edge computing
- ✓ Data compression
- ✓ Cloud servers
- ✓ Wireless comms

Machine-learning

- ✓ Train speed & length
- ✓ Predict blockage time
- ✓ Predict duration
- ✓ Predict traffic delay
- ✓ Predict traffic recovery

Patented
Machine-Learning
Algorithms

FEDERAL RAILROAD ADMINISTRATION
WORKSHOP & RESEARCH PROJECT

- Research Needs Workshop

- Highway-Rail Grade Crossing Requirements for AVs

V2R COMPONENTS

- ✓ Communications
- ✓ Onboard sensors
- ✓ Roadside sensors
- ✓ Mapping (Live, 3D, HD)
- ✓ Software & Integrators

V2R ISSUES

- ✓ CAV not high on RR list
- ✓ PTC not for CAV
- ✓ Redundancy needed
- ✓ Fail-to-safe critical
- ✓ Security essential

NATIONAL RESEARCH COUNCIL
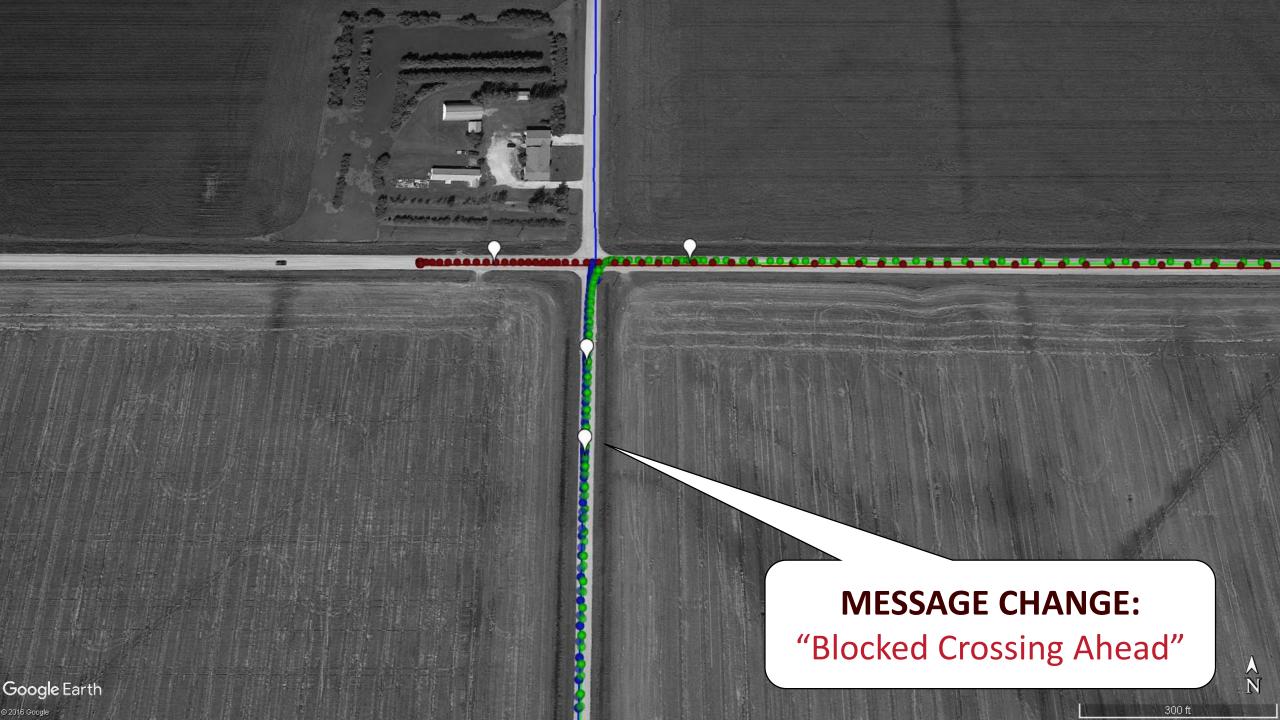**VEHICLE-TO-RAILROAD (V2R) PROTOTYPE**

- "Virtual Basic Safety Message" (BSM) / RSA development
- DSRC message propagation & security
- Prototype development and testing
- Process for proposing standards with SAE

1400 m

1400 m

MESSAGE:
"Railway Crossing Ahead"

Google Earth

© 2016 Google

N

3000 ft

MESSAGE CHANGE:
"Blocked Crossing Ahead"

Google Earth

© 2016 Google

300 ft

150 m

250 m

400 m

300 ft

When to send messages

- **Mobility vs Safety Applications**
  - Mobility – Routing messages
  - Safety – Stopping messages

- **Static vs Dynamic Geofences**
  - Static – less precise, conservative, less computational requirements
  - Dynamic – more precise, increases computation requirements

- **Geofence Boundaries**
  - Calculation boundary (approach road, intersections, signal vs stop)
  - Danger zone (stop point, clear point, warning time, clearance time)
  - Decision flow chart (sequence of questions)

Information needs

- **Vehicle characteristics**
  - Position, speed, heading, length, acceleration/deceleration properties, stopping distance, time to stop point

- **Train characteristics**
  - Position, speed, heading, acceleration/deceleration properties, arrival time, clearance time

- **Road/traffic characteristics**
  - Stop point, clearance point, far-side traffic queue, posted speed limit

- **Crossing characteristics**
  - Protection type, warning time, clearance time

CONCLUDING REMARKS

- **Train detection technologies to support "VBSM"**

- **Specific V2R development issues**
  - Mobility vs Safety

  - Static vs Dynamic Geofences

  - Message propagation

  - Railroad data availability

TRAINFO

Safe and seamless mobility at railway crossings

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