

Development and Demonstration of a Cost Effective In-Vehicle Lane Departure and Advance Curve Speed Warning System

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Outline

- **Background**
- **Project Overview and Goals**
- **Development Status**
- **Field Tests and Results**
- **Summary and Next Steps**
- **Questions/Discussion**

Background

Problem:

- Horizontal curves crash rate is three times higher than that of the tangent road sections
- Half of the fatal accidents occur on curved roads



Existing Solutions:

- Lane departure warning systems (rumble strip, video/sensor/GPS based solutions)
- Advance curve speed warning systems (warning signs, rumble strip)

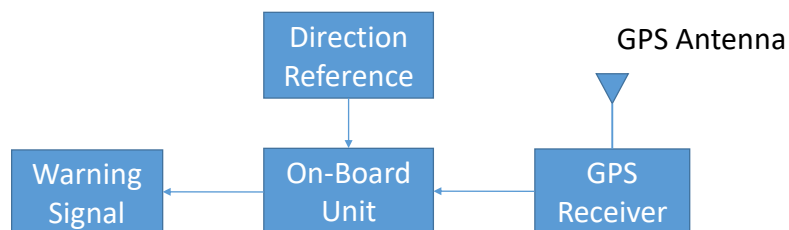


Problems with Existing Solutions:

- Expensive (implemented on high end vehicles)
- Performance (severe weather, clear road marking signs)



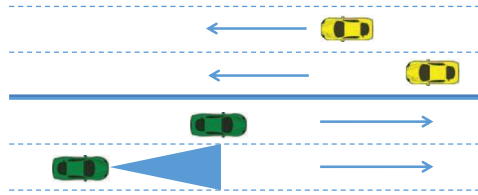
Proposed Project Overview



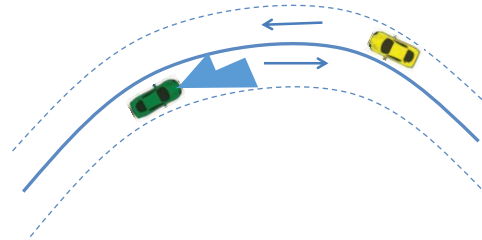
Features:

- Cost Effective (not uses video, differential GPS or high resolution maps)
- Performance (weather proof, will not rely on road markings)
- Easily Implementable (as a smartphone app or as a feature in navigational devices)

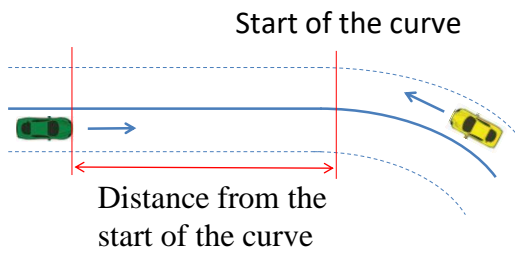
Goal 1: Lane Departure Warning



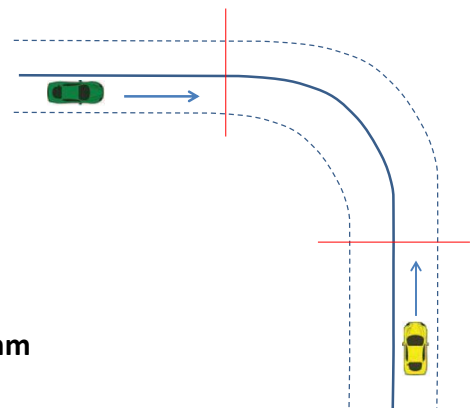
Lane departure detection and warning algorithm



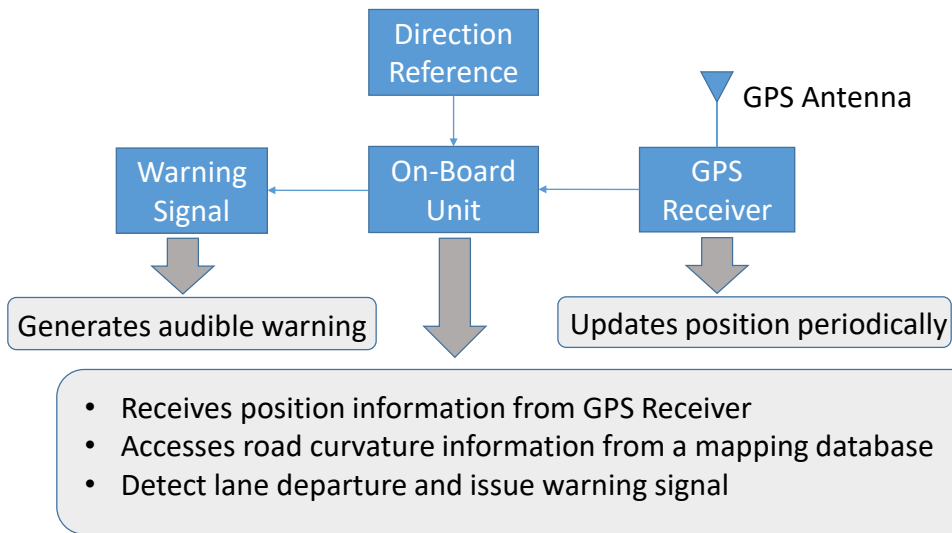
Goal 2: Advance Curve Speed Warning



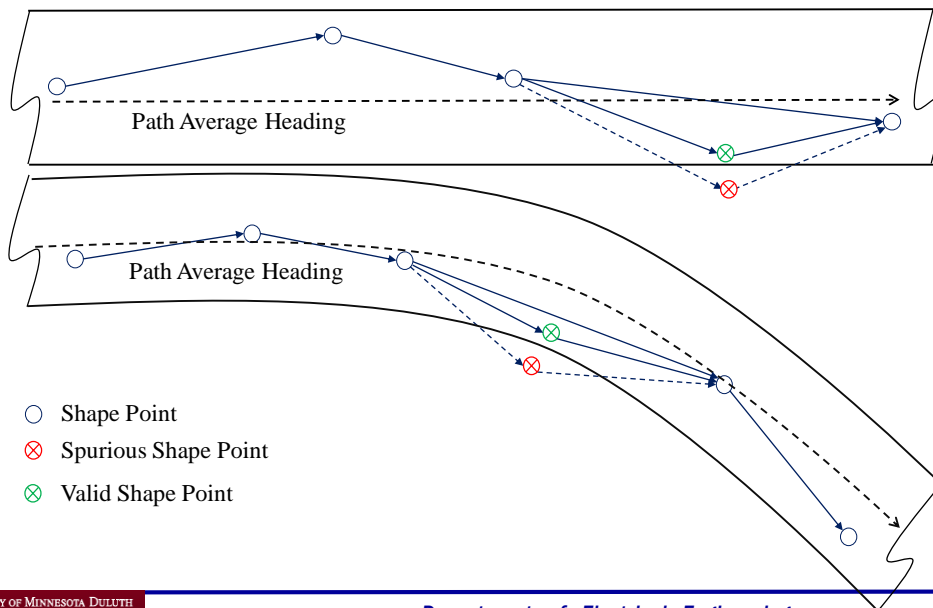
Advance curve speed warning algorithm



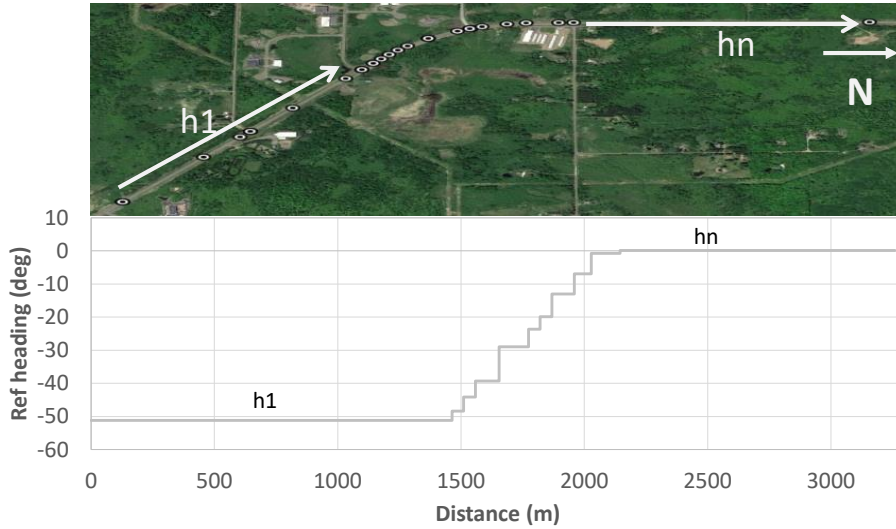
Implementation Plan



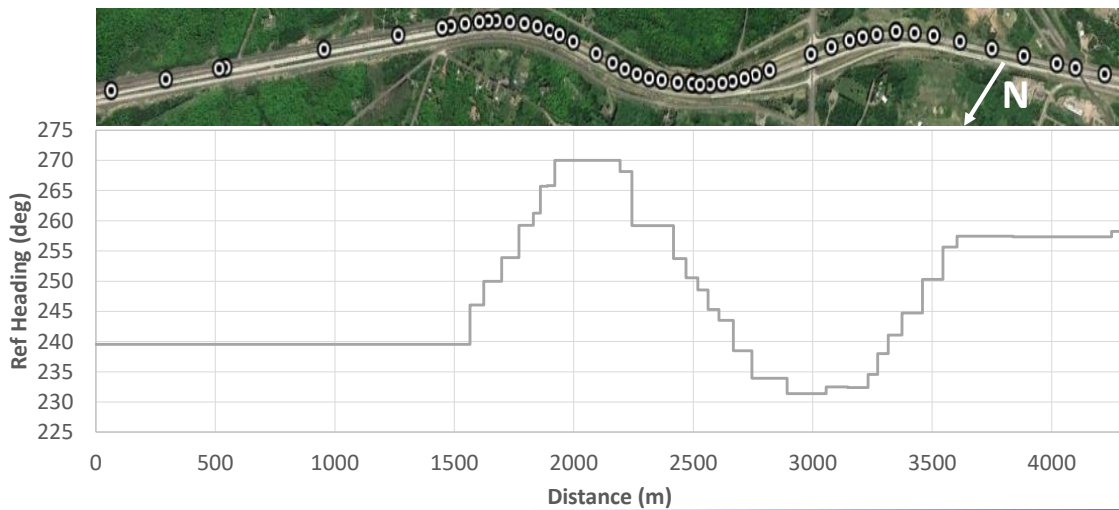
Reference Angle From Mapping Database



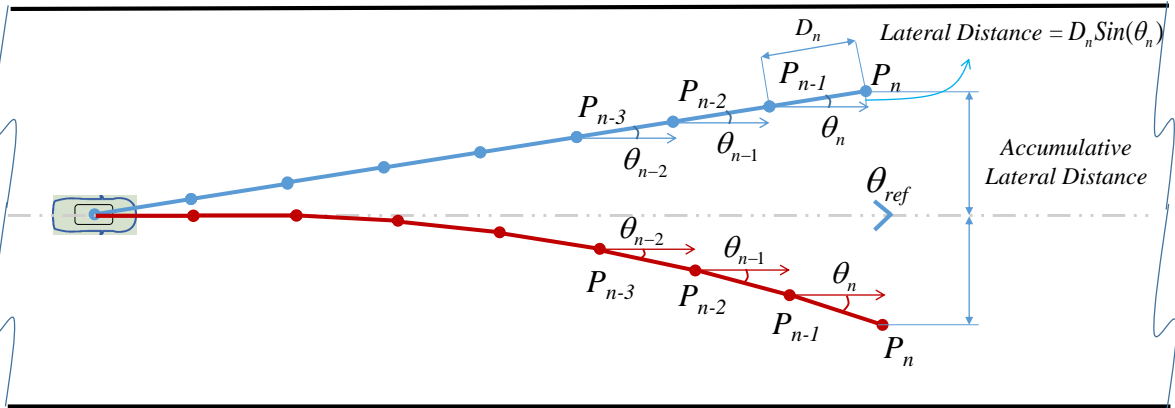
An Example of Reference Angle



A Freeway Example

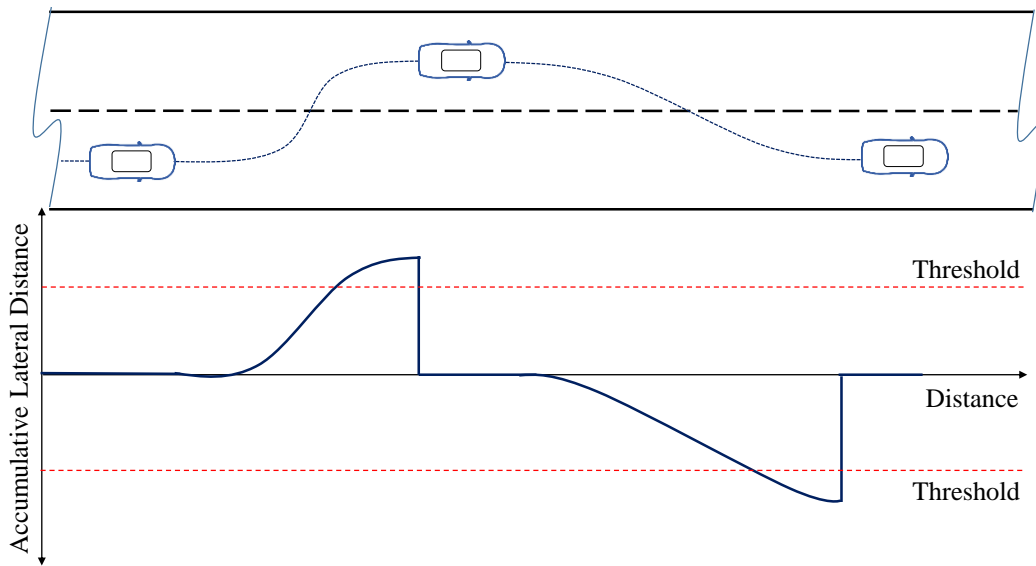


Constant Yaw and Steering Angle

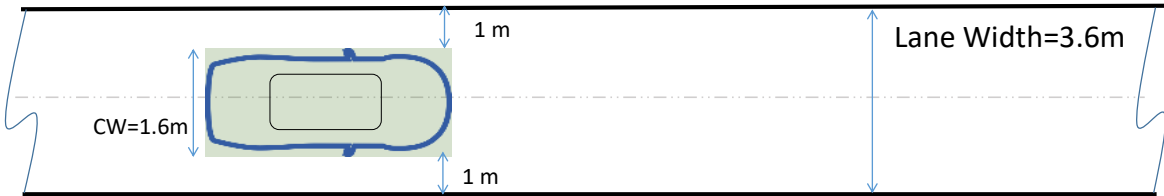
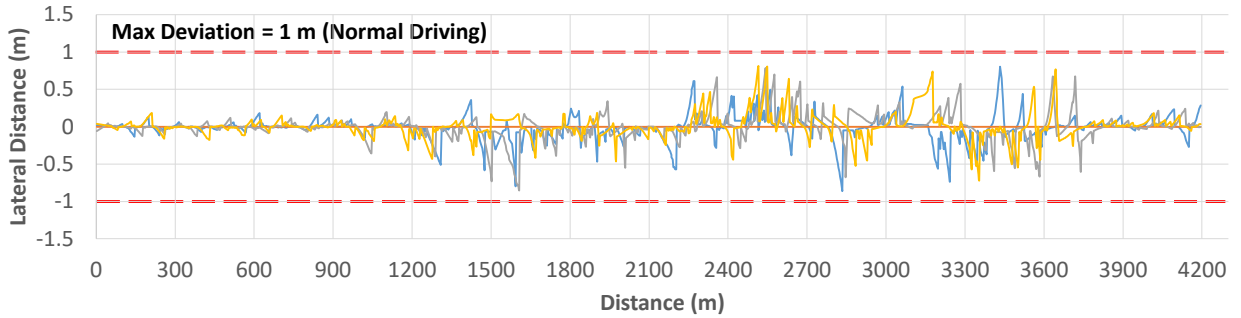


$$\theta_n = veh_heading - \theta_{ref}$$

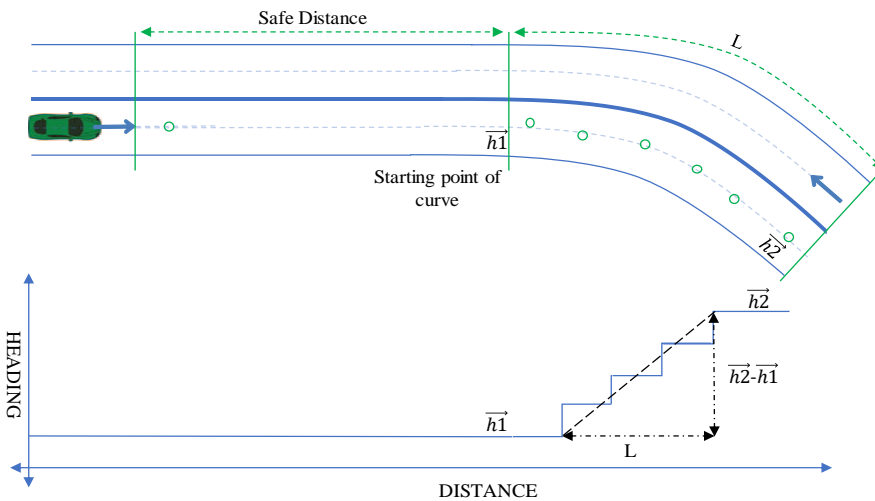
Lane Departure Detection Algorithm



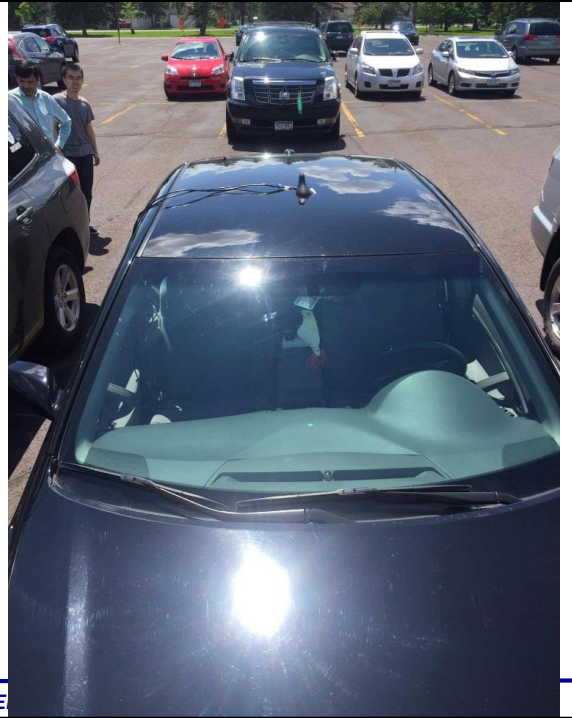
Lateral Distance Threshold



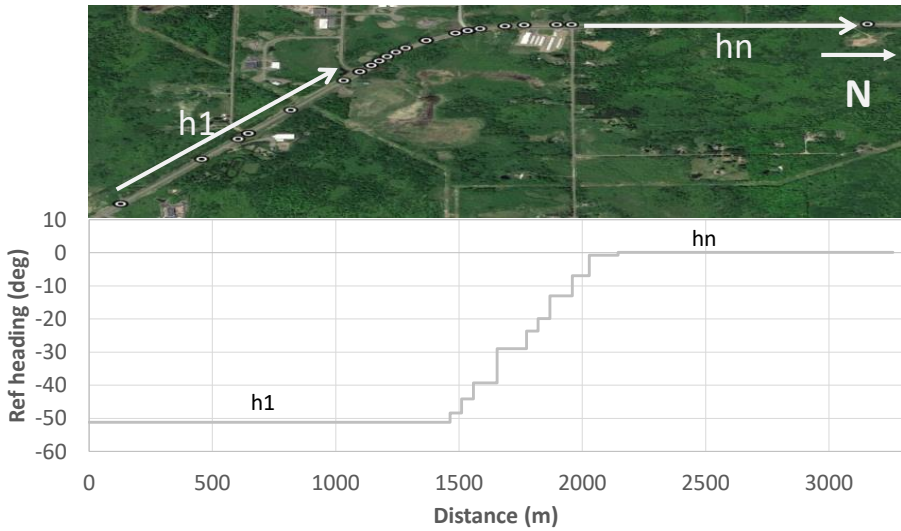
Advanced Curve Detection Algorithm

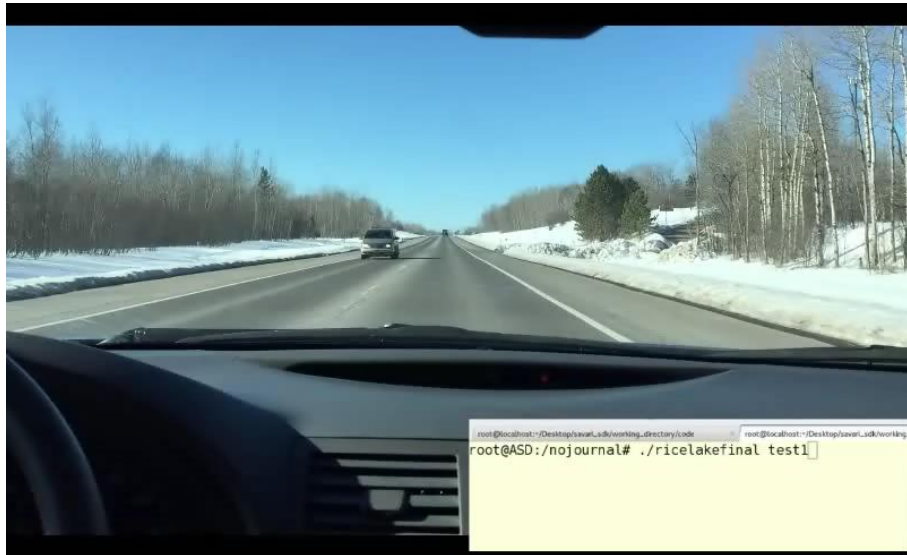


Field Tests

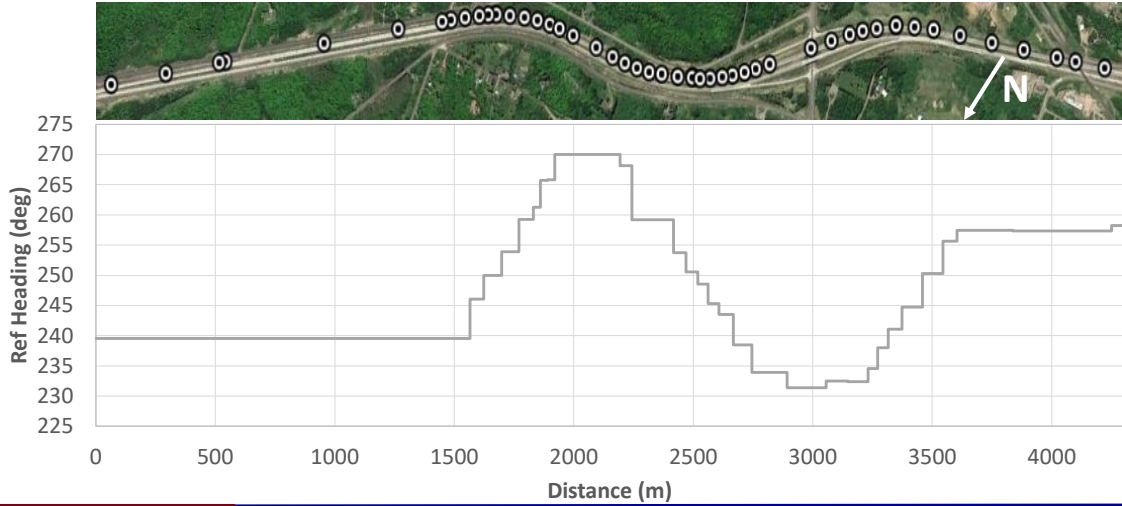


Field Tests on Rice Lake Rd.



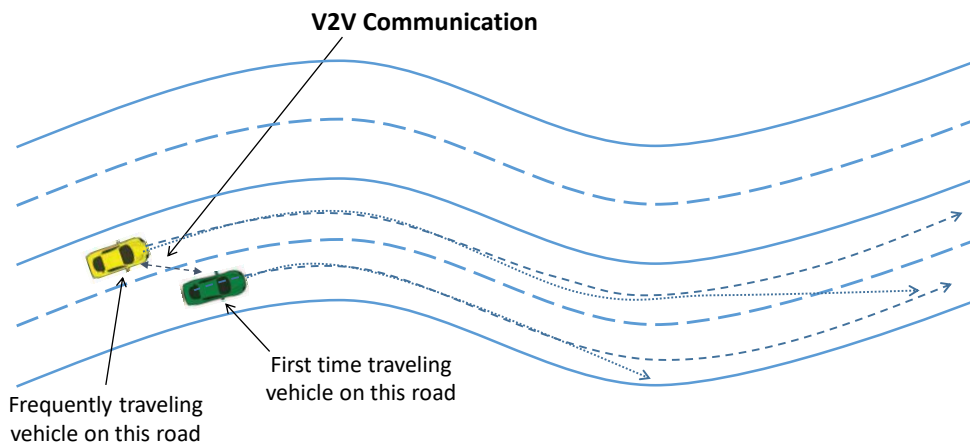


Field Tests on I-35

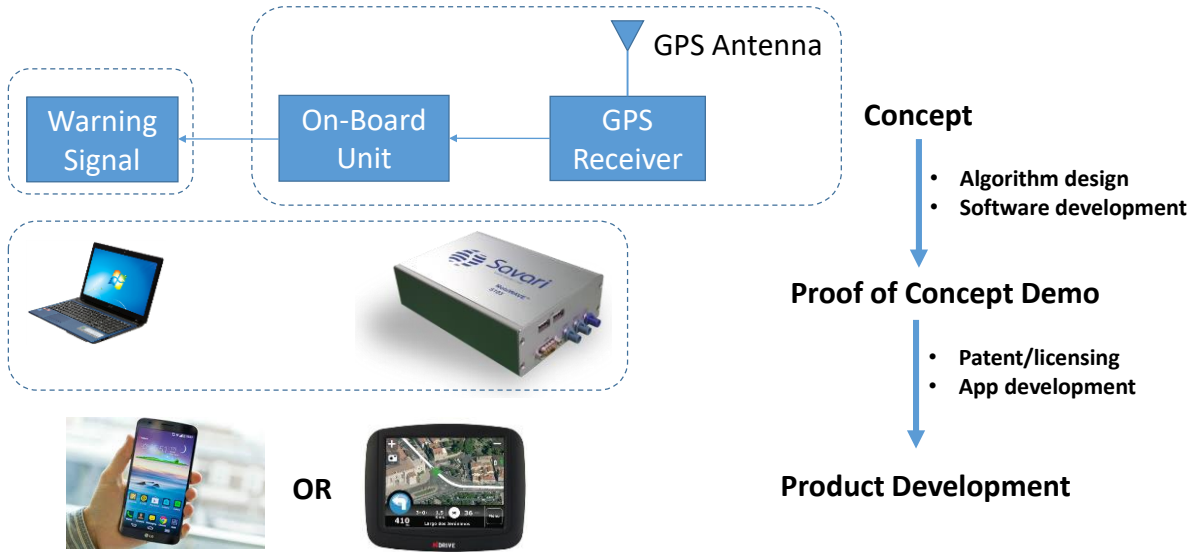




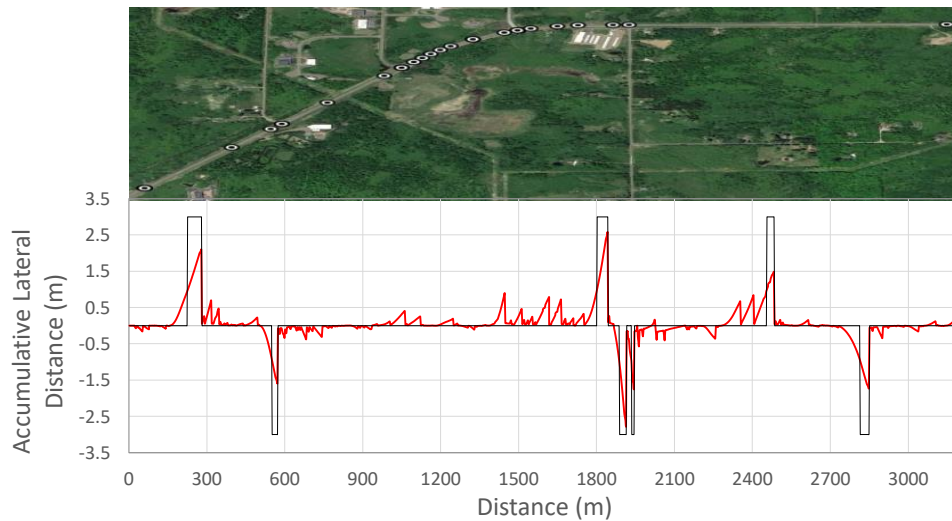
Next Steps: Reference Angle via Past Trajectory and/or V2V Communication



Summary



A Sample Result: Rice Lake Rd



A Sample Result: I-35 Interstate

