ROADWAY SAFETY INSTITUTE

Advancing roadway safety with user-centered solutions

UTC Project Information	
Project Title	Developing a Digital Highway Framework to Serve County Roads
University	University of Minnesota
Principal Investigator	Max Donath
PI Contact Information	donath@umn.edu 612-625-2304
Funding Source(s) and Amounts Provided (by each agency or organization)	Local Road Research Board (LRRB): $86,489
Total Project Cost	$86,489
Agency ID or Contract Number	UTC Grant Number: DTRT13-G-UTC35 MnDOT contract 99008 work order 115 CTS# 2014019
Start and End Dates	07/08/2013 – 05/31/2015
Brief Description of Research Project	*Final report abstract:* Our objective is the development and evaluation of a low-cost, vehicle-mounted sensor suite capable of generating map data with lane and road boundary information accurate to the 10 cm (4 in) level. Such a map could be used for a number of different applications including GNSS/GPS based lane departure avoidance systems, smart phone based dynamic curve speed warning systems, basemap improvements, among others. The sensor suite used consists of a high accuracy GNSS receiver, a side-facing video camera, and a computer. Including cabling and mounting hardware, the equipment costs were roughly $30,000. Here, the side-facing camera is used to record video of the ground adjacent to the passenger side of the vehicle. The video is processed using a computer vision algorithm that locates the fog line within the video frame. Using vehicle position data (provided by GNSS) and previously collected video calibration data, the fog line is located in real-world coordinates. The system was tested on two roads (primarily two-lane, undivided highway) for which high accuracy (<10 cm) maps were available. This offset between the reference data and the computed fog line position was generally better than 7.5 cm (3 in). The results of this work demonstrate that it is feasible to use a camera to detect the position of a road's fog lines, or more broadly any other lane markings, which when integrated into a larger mobile data collection system, can provide accurate lane and road boundary information about road geometry.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	Since the end of this project, Donath and his team have used the technology to digitize several roads for MnDOT around Windom, MN. Windom is using the digital information for the driver-assist systems in their snowplows. This project has also led to the development of a new driver assist system for snowplow operators dealing with white out conditions provides guidance to the operator as to where the snowplow is on the road in 1 foot lateral increments. The first prototype, operating on MN25 between Belle Plaines and Green Isles, MN, uses a map developed and deployed based on this project. Donath and his team recently completed a follow-up study to this project ("Test and Demonstration of Connected Vehicles Applications to Maintenance Operations") and submitted a proposal for additional MnDOT/LRRB funding in September 2018. That funding was granted; a new project called "Implementation of Lane Boundary Guidance System for Snowplow Operations" began on July 1, 2019. As part of that project, the system will be deployed and evaluated in MnDOT's District 7 and on various routes in Dakota County, with the possibility of an additional deployment in MnDOT's District 4.
Impacts/Benefits of Implementation (actual, not anticipated)	The new driver assist system has received substantial positive feedback. It was jointly developed with Chen-Fu Liao and Nichole Morris. MnDOT is exploring testing these in several locations across the state of Minnesota.
Web Links • Reports • Project website	http://www.cts.umn.edu/Research/ProjectDetail.html?id=2014019 http://www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=2412