Ford, Virginia Tech Go Undercover to Develop Signals That Enable Autonomous Vehicles to Communicate with People

- Ford and Virginia Tech Transportation Institute are testing a Ford-designed method for self-driving vehicles to communicate their intent to pedestrians, human drivers and bicyclists in an effort to create a standard visual language people can easily understand.
- Study simulates a self-driving vehicle using a “seat suit” to conceal the human driver to explore pedestrian reaction to external lighting signals that indicate when the vehicle is driving, yielding or accelerating from a stop.
- Developing a way for self-driving vehicles to communicate is essential since cues like hand waves or head nods between human drivers and pedestrians will not necessarily factor in to autonomous driving scenarios.

WASHINGTON, D.C., Sept. 13, 2017 – Today, a simple head nod or hand wave from a driver is usually enough to indicate it’s okay for a pedestrian to cross the street, but in an autonomous vehicle future, how will a self-driving car with no human driver communicate with pedestrians, cyclists or humans operating other cars on the road?

Looking to prepare for this eventual reality, Ford Motor Company partnered with Virginia Tech Transportation Institute, to conduct a user experience study to test out a method for communicating a vehicle’s intent by soliciting real-world reactions to a self-driving car on public roads.

“Understanding how self-driving vehicles impact the world as we know it today is critical to ensuring we’re creating the right experience for tomorrow,” said John Shutko, Ford’s human factors technical specialist. “We need to solve for the challenges presented by not having a human driver, so designing a way to replace the head nod or hand wave is fundamental to ensuring safe and efficient operation of self-driving vehicles in our communities.”

As part of Ford’s efforts to ensure autonomous vehicles can safely share the road with humans, the joint research project set out to investigate the most effective means for the vehicle to communicate. The team considered using displayed text, but that would require people all understand the same language. The use of symbols was rejected because symbols historically have low recognition among consumers.

In the end, the researchers decided lighting signals are the most effective means for creating a visual communications protocol for self-driving vehicles. As light signals for turning and braking indication are already standardized and widely understood, they determined the use of lighting signals is best to communicate whether the vehicle is in autonomous drive mode, beginning to yield, or about to accelerate from a stop.

So Ford outfitted a Transit Connect van with a light bar placed on the windshield. To simulate a fully self-driving experience without using an actual autonomous vehicle, the Virginia Tech Transportation Institute team developed a way to conceal the driver with a “seat suit.”

The suit creates the illusion of a fully autonomous vehicle, which is necessary to test and evaluate real-world encounters and behaviors. The researchers then went to work experimenting with three light signals to test the communication of the vehicle’s intent:

- Yield: Two white lights that move side to side, indicating vehicle is about to yield to a full stop
- Active autonomous driving mode: Solid white light to indicate vehicle is driving autonomously
- Start to go: Rapidly blinking white light to indicate vehicle is beginning to accelerate from a stop

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The simulated autonomous Transit Connect was driven on public roads in northern Virginia – home to a density of traffic and pedestrians – throughout August, with researchers capturing video and logs of pedestrian reactions. More than 150 hours of data over approximately 1,800 miles of driving was collected in an urban environment, including encounters with pedestrians, bicyclists and other drivers. External signals were activated more than 1,650 times at various locations around Arlington, Va., including at intersections, parking lots, garages, airport roadways, and various other locations.

Numerous high-definition cameras mounted in the study vehicle provided a 360-degree view of surrounding areas and captured the behavior of other road users. This data will be valuable to understanding if other road users change their behaviors in response to self-driving vehicles and the signals they employ.

“This work is of value not only to vehicle users and manufacturers, but also to anyone who walks, rides or drives alongside autonomous vehicles in the future,” said Andy Schaudt, project director, Center for Automated Vehicle Systems, Virginia Tech Transportation Institute. “We are proud to support Ford in developing this important research.”

Creating an industry standard

Ford is already working with several industry organizations to push toward creation of a standard, including the International Organization for Standardization and SAE International. A common visual communications interface most people can understand across all self-driving vehicles in all locations will help ensure safe integration into transportation systems. Ford is also working on ways to communicate with those who are blind or visually impaired as part of a separate work stream.

“Preparing for a self-driving future is going to take all of us working together,” said Shutko. “That’s why we’re developing and advocating for a standard solution so it can be adopted by the industry and applied to all self-driving vehicles.”

About Ford Motor Company

Ford Motor Company is a global company based in Dearborn, Michigan. The company designs, manufactures, markets and services a full line of Ford cars, trucks, SUVs, electrified vehicles and Lincoln luxury vehicles, provides financial services through Ford Motor Credit Company and is pursuing leadership positions in electrification; mobility solutions, including self-driving services; and connected services. Ford employs approximately 188,000 people worldwide. For more information regarding Ford, its products and Ford Motor Credit Company, please visit www.corporate.ford.com.

About Virginia Tech Transportation Institute

The Virginia Tech Transportation Institute conducts research to save lives, time, and money and protect the environment. As one of seven premier research institutes created by Virginia Tech to answer national challenges, VTTI is continually advancing transportation through innovation and has impacted public policy on national and international levels. For more information, please visit http://www.vtti.vt.edu.