VIRGINIA TECH
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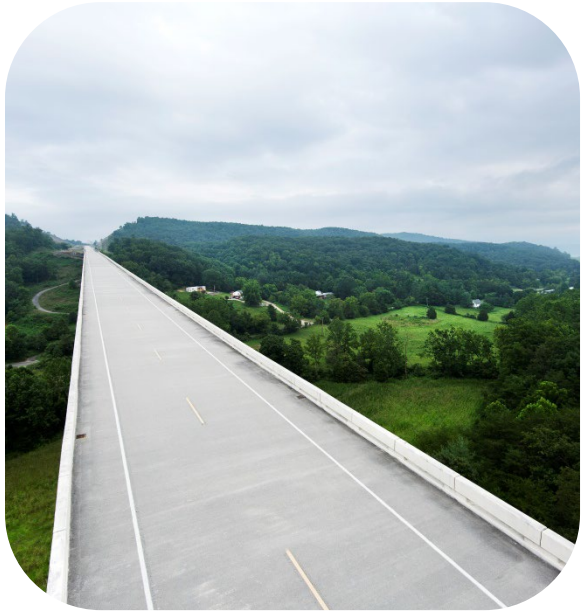
Conveying Automated Vehicle ‘Intentions’

AV VIZ



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Study Overview

- Evaluate different HMI systems for Highly Automated Vehicles (HAVs)

- Allow participants to experience an automated vehicle (L4 equivalent)
  - 4 unique HMI conditions used to display vehicle 'intentions' (driving information relevant to HAV users)
    - Baseline (no HMI)
    - Visual only (3d modeled world)
    - Auditory only
    - Mixed Modal (visual and auditory)
  - 6 vehicle scenarios

- Measure participants' feeling of trust, safety, and comfort in the vehicle as they experience the maneuvers
  - Important: no one is in the driver's seat, the research team wants the experience to feel as authentic as possible
    - There is a safety driver in the front passenger seat, but they are pretending to be a participant in the study

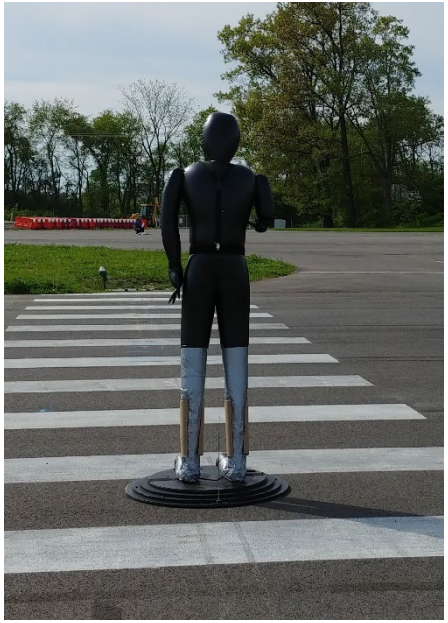
Research Rationale and Questions

- Pew research states that 56% of Americans say they would not want to ride in a ‘driverless car’ given the chance, citing distrust of the system as the biggest contributing factor
  - Through this research we want to see which HMI types most increase user trust in these driving systems

- Research Questions:
  1. What type of HMI systems most increases users’ situation awareness of the driving landscape and understanding of the automated systems intended actions?
  2. Will giving users more detailed information about the HAV (path prediction, threat detection, etc.) improve their sense of safety and trust in the driving system?
  3. Does heightened awareness and understanding of the system result in better decision making by the user in potentially risky situation? Or will the become over-reliant in the system?
  4. In unfamiliar situations, how accurately will users identify a system malfunction?

Approach

- Participants first experience a baseline scenario in the test vehicle
  - No HMI is available, no potential threats or obstacles are navigated
  - A questionnaire is completed to assess feeling of trust, comfort, and safety
- The HMI is turned on and several further scenarios are experienced by the participants
  - For these scenarios there are a mix of vehicles, human actors, and inflatable targets used to increase the complexity of the driving environment
  - Again, questionnaires are used after each scenario to assess users' feeling of trust, comfort, safety, and understanding of the HMI solution
- For the final scenario, the HMI system is programmed to 'malfunction' and stop providing full information to the user
  - During this scenario, participants are put into a conflict with the inflatable target where the vehicle is programmed to not 'sense' the simulated pedestrian and fail to yield ultimately striking it



Implementation

- All HMI systems were developed in Unity3D
- A ‘Wizard of Oz’ approach was used for scenarios where the research vehicle was interacting with other road users (vehicles and pedestrians)
  - Geofence areas were used to trigger scenarios
  - This allows for simulating advanced object detection