



# CENTER FOR CONNECTED AND AUTOMATED TRANSPORTATION

Project Title	Development of Situational Awareness Enhancing Systems for AV- Manual Handover and Other Tasks	
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Most relevant CCAT research thrusts (choose all applicable)	<input type="checkbox"/> Control & Operations <input checked="" type="checkbox"/> Enabling Technology <input checked="" type="checkbox"/> Human Factors <input type="checkbox"/> Infrastructure Design & Management <input checked="" type="checkbox"/> Modeling & Implementation <input type="checkbox"/> Policy & Planning	
Funding Request	\$100,000	
Matching Funds and Source (if any)	\$100,000 (Indiana DOT \$25,000; Delft University \$25,000; Chang An University \$50,000)	
Total Project Cost	\$200,000	
Contract Number	69A3551747105	
Project start/end dates	01/01/2021 - 09/30/2022	
Project Abstract	<p>Partially and conditionally automated vehicle systems (AVS) can assist drivers with their driving tasks and have the potential to significantly reduce driving-related burden. Drivers still play a critical role such as monitoring the driving environment when the AVS is engaged and performing certain driving tasks when called upon by the system. However, there is ample evidence in the literature and real-world that drivers cannot maintain necessary situational awareness to safely take over the vehicle when needed due to task underload, vigilance decrement, or over-trust in AVS capabilities. There is a critical need to design mechanisms that assist drivers in maintaining a certain level of situational awareness for promoting a smooth and safe transition to full vehicle automation in the future. This study aims to design an in-vehicle situational awareness</p>	





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	<p>enhancing system (SAES) to facilitate AV-manual take-over in partially and conditionally automated vehicles. In the first phase, we will develop a periodic visual prompts-based SAES for directing drivers' attention to selected areas of interest and evaluate its impacts on drivers' situational awareness and takeover performance. In the second phase, we will develop SAES that generates dynamic visual prompts based on drivers' level of situational awareness, and dynamic road and traffic conditions. This study will conduct interactive driving simulator-based experiments with SAES to collect driver physiological data (e.g., eye gaze patterns, heart rate, and brain electrical activity) and micro-level driving performance (e.g., steering wheel angle and acceleration/deceleration). The collected data will be used to model the impacts of SAES on drivers' situational awareness and takeover performance in partial and conditional automation driving environments.</p>
<p>High-level implementation plan</p>	<p>Implementation of this research product will mean adopting the developed in-vehicle situational awareness enhancing system (SAES) using eye-tracking technology by installing it in partially and conditionally automated vehicles, for take-over purposes. When deployed, SAES will be expected to mitigate the issues related to task underload, vigilance decrement, and reduced situational awareness for drivers. We expect that the proposed SAES can be easily bootstrapped to the existing vehicles.</p>
<p>Project Metrics</p>	<ul style="list-style-type: none"> <li>• Number of papers presented at nationally and internationally renowned conferences</li> <li>• Number of journal papers published</li> <li>• Number of graduate student theses</li> <li>• Media stories and website hits</li> <li>• Number of public outreach events</li> </ul>
<p>Web Links: [leave blank until project approval]</p>	<p><a href="http://ccat.umtri.umich.edu">ccat.umtri.umich.edu</a>  <a href="https://engineering.purdue.edu/ccat">https://engineering.purdue.edu/ccat</a>  <a href="https://www.purdue.edu/discoverypark/cav/nextrans/index.php">https://www.purdue.edu/discoverypark/cav/nextrans/index.php</a></p>

