



# CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

<b>Name(s)</b> <b>Rafael Cosman; Aaron Schild</b>	<b>Project Number</b> <b>S0906</b>
<b>Project Title</b> <b>Sun in Your Eyes? Electrochromic Sun-Tracking Windshield</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The Electrochromic Sun-Tracking Windshield (ESTW) is an automatic machine vision system for cars which determines when the sun is in the driver's field of view and rapidly darkens a small portion of the windshield to block the direct sunlight. The goal is to minimize dangerous driver distraction due to bright, low-angle sunlight and eliminate the need for manual sun visors.</p> <p><b>Methods/Materials</b> The engineering project involved system design, parts acquisition and integration, and creation of image analysis and camera calibration software. The project has been taken from initial concept through testing and deployment on a vehicle driving on city streets.</p> <p>The ESTW prototype consists of six major components: ultrasonic range finder, camera, computer, microcontroller, relay circuits, and electrochromic panels. The camera sends images to the processing unit, which analyzes them to determine the sun's angle relative to the driver's eyes. The software instructs electrical relays to activate the specific panels necessary to block the distracting sunlight. Electrochromic gel in the panels darkens with the application of voltage. When sunlight is no longer in the driver's eyes, the panels quickly return to a transparent state. The ultrasonic range finder determines the driver's position in an initial calibration step, allowing the software to calculate the angle from the driver's eyes to each panel.</p> <p><b>Results</b> The ESTW was tested on several days during the late afternoon, when a sun visor is frequently necessary. As the car moved, the ESTW darkened the appropriate panels to block the direct sunlight.</p> <p><b>Conclusions/Discussion</b> The ESTW tracks and rapidly attenuates direct sunlight, eliminating the need for a sun visor during real-world driving conditions. The ESTW technology can be extended to other vehicular scenarios including ships, aircraft, and spacecraft. The ESTW has the potential to reduce driver distraction, automobile injuries, and loss of life.</p>	
<b>Summary Statement</b> The Electrochromic Sun-Tracking Windshield (ESTW) is an automatic machine vision system for cars which determines when the sun is in the driver's view and rapidly darkens a small portion of the windshield to block the direct sunlight.	
<b>Help Received</b> Received \$500 COSMOS-Intel grant; Gentex Corporation donated 40 electrochromic glass panels; Capturix donated video-capturing software	