



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2019 PROJECT SUMMARY**

<b>Name(s)</b> <b>Adhip Raghunathan</b>	<b>Project Number</b> <b>J1026</b>
<b>Project Title</b> <b>Novel Electrochromic System to Regulate Internal Lighting</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to create a smart window to maintain indoor light levels within 20% of 45 lux when external light levels are between 150 and 700 lux. This system would automatically increase the opacity of a window to prevent an indoor space from being excessively bright from direct sunlight. Although this system could be recalibrated to maintain any light level, approximately 50 lux is recommended for most indoor spaces by National Science Foundation.</p> <p><b>Methods</b> A test apparatus was constructed to enclose a small volume, such that all internal light had to enter through a window. Two layers of insulated electrochromic film were carefully layered together and placed over the window. A photoresistor was placed outside the test apparatus to measure external light levels. Similarly, a photoresistor was placed inside the test apparatus to measure internal light levels. Based on the lighting levels, an Arduino microcontroller and relays turned the smart windows on or off. Data was collected from the Arduino serial monitor and exported to an Excel spreadsheet.</p> <p><b>Results</b> In the control group, we observed that for a 1 lux increase in external light levels, internal light levels increased by 0.396 lux. As external light levels increased above 200 lux, internal light levels passed 45 lux. In the first trial, internal light levels stayed between 40 and 50 lux (11%) for external light levels between 150 and 700 lux. In the second trial, internal light levels stayed between 38 and 50 lux (16%) for external light levels between 150 and 700 lux. In the third trial, internal light levels stayed between 38 and 50 lux (16%) for external light levels between 150 and 700 lux.</p> <p><b>Conclusions</b> This method of using computer-controlled electrochromic film to gradually increase the opacity of a window is effective in maintaining the internal light levels at within 16% of 45 lux. This meets the goal of maintaining internal light levels within 20% of 45 lux.</p>	
<b>Summary Statement</b> A smart window to maintain indoor light levels.	
<b>Help Received</b>	