



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> Neil Gandhi; Quentin Wetherholt	<b>Project Number</b> <b>S0997</b>
<b>Project Title</b> <b>Implementing an Optical Method in an Open Platform Multi-touch Computer Interface</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Our goal is to build a multi-touch computer interface that combines both the powerful processing power of a modern day computer and effective interface of a touch screen device in an open platform.</p> <p><b>Methods/Materials</b> When light strikes a boundary of a medium at an angle higher than the critical angle, all of the light will be internally reflected within this medium, hence the name total internal reflection. In this project, 850 nm infrared light was illuminated into a sheet of acrylic at a near-parallel angle, causing total internal reflection. When a human finger touches the acrylic surface, the light would scatter downwards at that point and a webcam modified with a visible light filter situated orthogonally underneath the acrylic surface would pick up these disturbances and send this data to software, which would translate it into mouse clicks, thereby allowing multi-touch control of the computer. By illuminating an LED projector onto an opaque acrylic surface, we were able to build the entire multi-touch computer interface for under \$400.</p> <p><b>Results</b> Our devices forty-inch display and ability to translate over thirty fingers of interaction combined with a strong processing power has revolutionary implications for a wide range of uses. For example, while currently airport kiosks can only service users individually, our 40-inch multi-touch table would allow a family of three to easily input all their information on three different windows and process their boarding passes simultaneously. As another example of the computer's broad utility, users who want to learn the piano can simply open up the virtual piano application on the first half of the screen and video tutorials from Youtube on the other half of the screen to learn how to play the instrument. These are unique and patentable applications.</p> <p><b>Conclusions/Discussion</b> In this novel approach to building a multi-touch interface, our project combines three unique ideas. While most touch screens are limited to ten finger input, our computer's unique design allows up to thirty fingers to input information simultaneously, allowing for multiple user interaction. Also, the computer is an open platform, so it is not limited to a specific operating system. Most importantly, the multi-touch effect can be powered by any PC unit, so it maximizes both a strong processing power and an effective interface.</p>	
<b>Summary Statement</b> Our project employs the theory of frustrated total internal reflection in order to create an open platform multi-touch interface for less than four hundred dollars by using skills from electrical and civil engineering.	
<b>Help Received</b>	