

LLP+: Multi-Touch Sensing Using Cross Plane Infrared Laser Light for Interactive Based Displays

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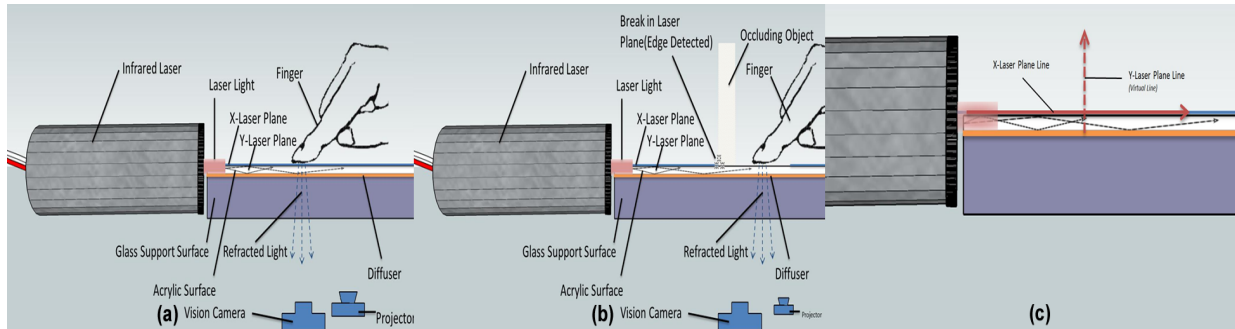


Figure 1: (a) LLP+ showing touch input detection without occlusion. (b) An occluding object (hazard) in front of touch input (finger). (c) Shows two planes of infrared light . The X-Laser Plane detects objects without occlusion while the Y-Laser Plane detects touch input points with object hazard.

1 Introduction

Multi-touch sensing exists in a number of applications and is presently used in personal computing devices (i.e. laptops and desktop computers), mobile touch screens, kiosks, Interactive wall displays (i.e. subway station map), ATMS, and any display requiring an interactive platform. Current multi-touch sensing methods use capacitive and or resistive based touchscreens both which are expensive and difficult to make. Infrared based touchscreens is being studied as an alternative method that is effective and low-cost solution of producing equal results particularly with large interactive displays.

Previous research using infrared based touch screens is not new and have been studied using several implementations most notably Jefferson Hans FTIR [Han 2005] implementation. However, each implementation has several limitations and a trade-off decision must be made when considering which technology to use. FTIR does not suffer from occlusion, but cannot detect objects and is well suited for detecting fingers and other point-based touch inputs. Microsoft's Surface uses a diffuse based infrared light source but does not do well with high ambient light. Another technology uses an infrared light plane on top of the interaction surface but suffers from occlusion when objects are placed in front of the touch input.

Our approach combines two technologies together to effectively eliminate limitations placed on the touch screen when only one implementation is used and reduces the complexity of design and cost.

2 Our Approach

Laser Light Plane Cross (LLP+) creates an occlusion free zone for interaction on display surfaces. It also increases the ability to detect multiple touch inputs other than fingers such as edges for object recognition. Since our design allows for the detection of edges, it offers the possibility of affordances to recognizing objects such as

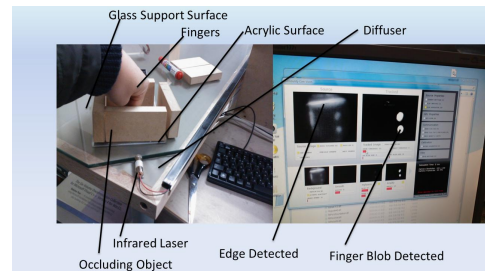


Figure 2: Results showing touch inputs (fingers) detected with four occluding objects.

mobile phones, wine bottles, cameras, and other large objects. Our design does not require a complaint surface to enhance touch experience. Unlike previous methods using infrared lasers our design does not suffer from occlusion while handling normal touch input detection without hazards (Figure 1a). It is an occlusion free surface and can recognize a touch input even when hazards block the line of sight of the laser module (as seen in figure 1b). The dual plane created by the lasers (as described in Figure 1c) is needed to handle obstructing objects. We tested our method on small piece of acrylic and used a four-block object hazard scheme to impede the touch input source. We used the Community Core Vision (CCV) software [NUI 2009] to track the points and detect edges created by the hazard (as seen in Figure 2).

References

HAN, J. Y. 2005. Low-cost multi-touch sensing through frustrated total internal reflection. In *UIST '05: Proceedings of the 18th annual ACM symposium on User interface software and technology*, ACM, New York, NY, USA, 115–118.

NUI, 2009. Nui group community, community core vision (ccv) software. <http://ccv.nuigroup.com/>.

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