

Inverted FTIR: Easy Multitouch Sensing for Flatscreens

Florian Echtler
Andreas Dippon
Marcus Tönnis
Gudrun Klinker

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Introduction

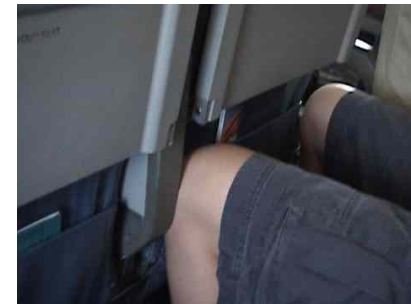
FTIR, DI and their limitations

- FTIR: *frustrated total internal reflection*
- DI: *diffuse illumination*
- both popular due to:
 - off-the-shelf components
 - easy construction
 - low price



limited LCD/Plasma support

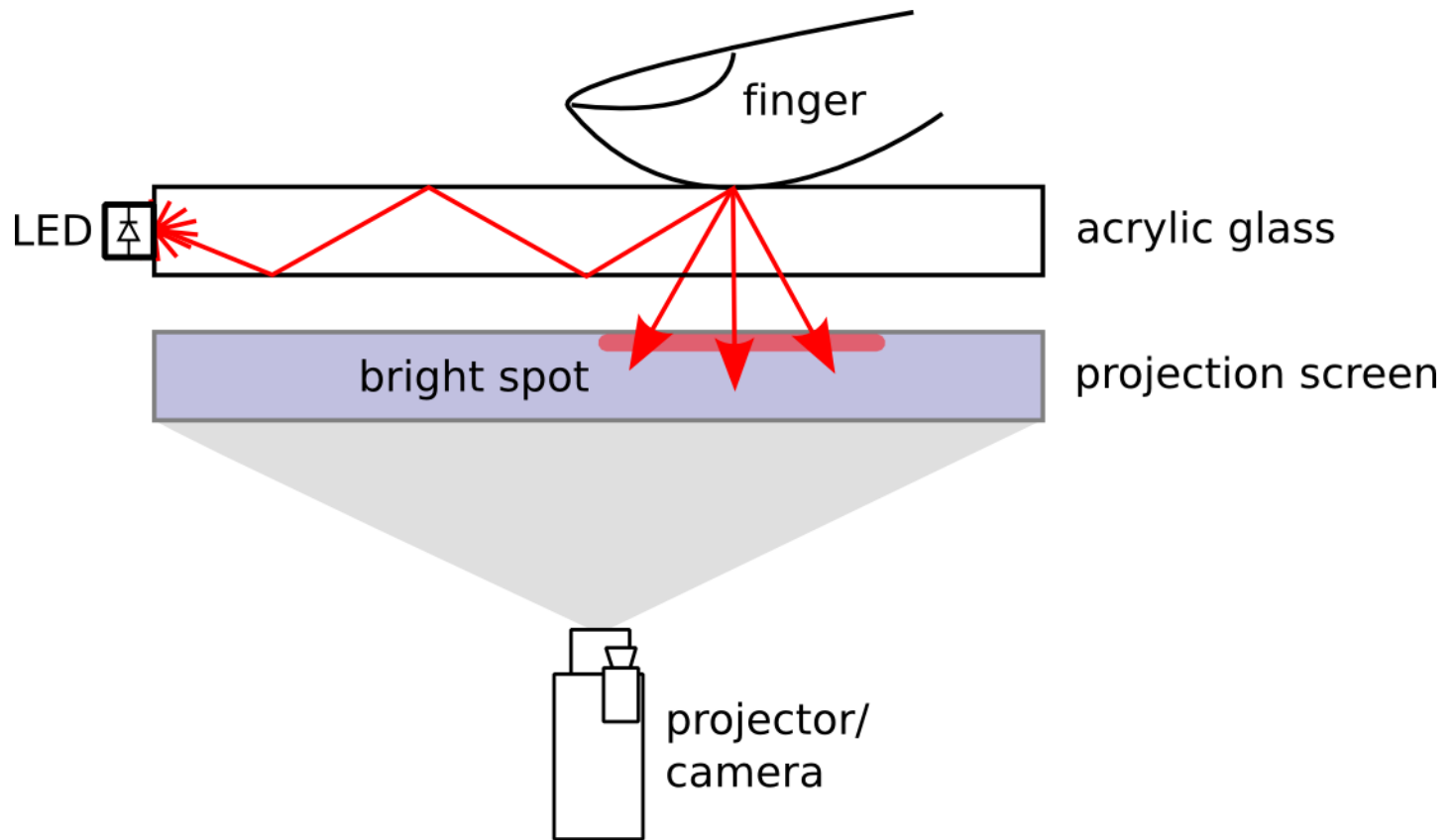
However..



no legroom

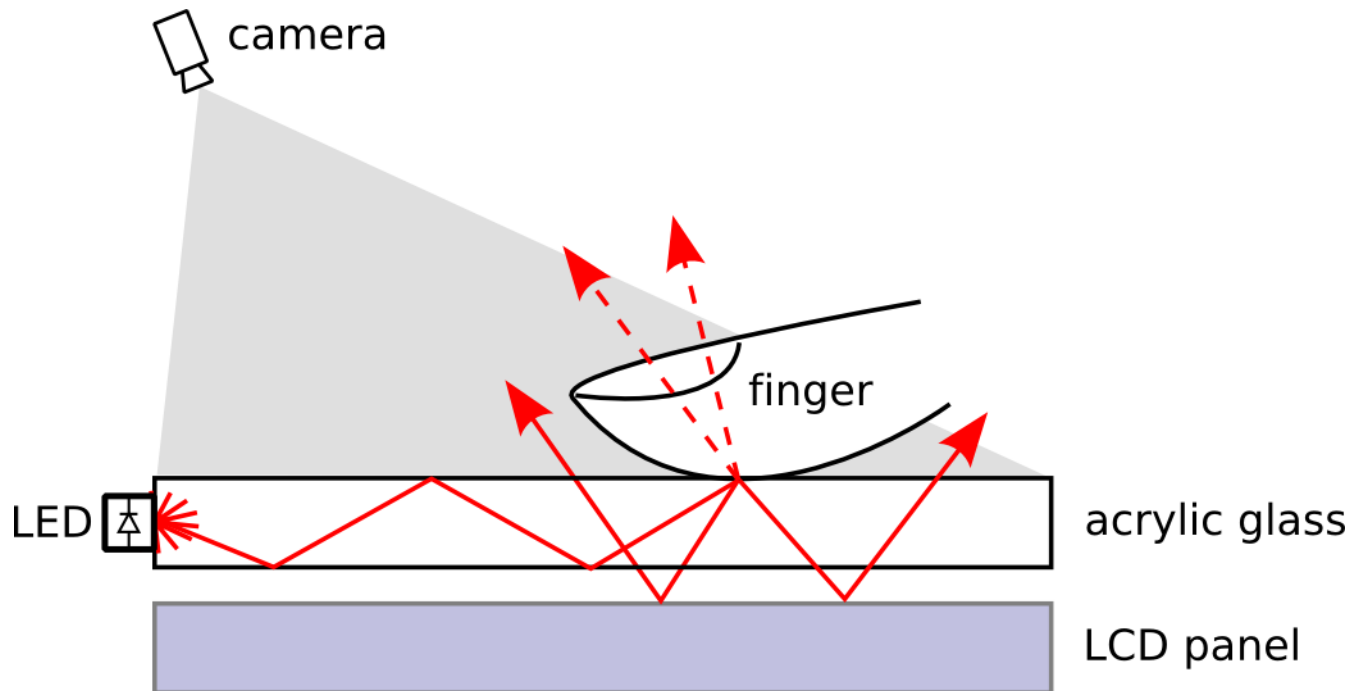
Reference: *Low-Cost Multi-Touch Sensing through Frustrated Total Internal Reflection*. J. Han, ACM UIST 2005.

“Regular” FTIR Rear-Mounted Camera



Inverted FTIR

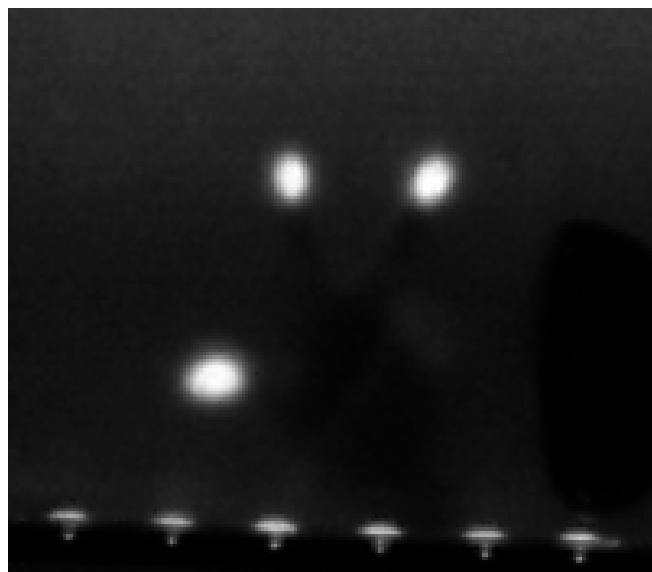
Front-Mounted Camera



Inverted FTIR

Closeup Images

Regular FTIR



Inverted FTIR



possible to use same image processing pipeline:
background subtraction, thresholding, denoising, blob detection

Inverted FTIR

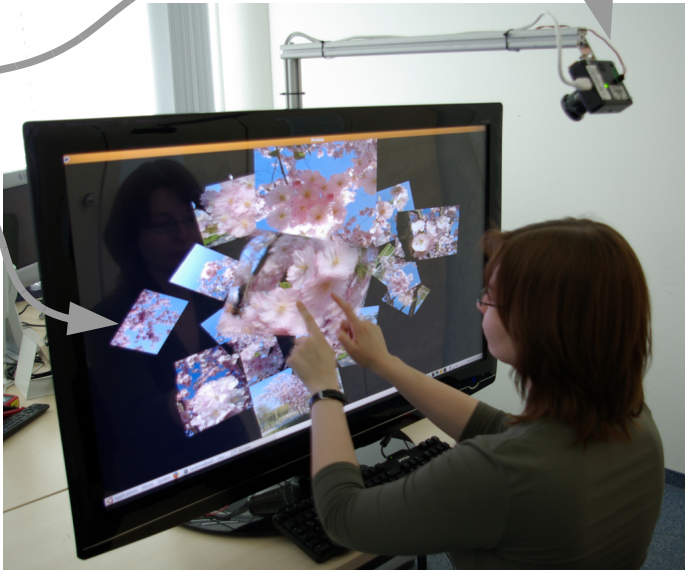
FlatTouch



camera

42" screen

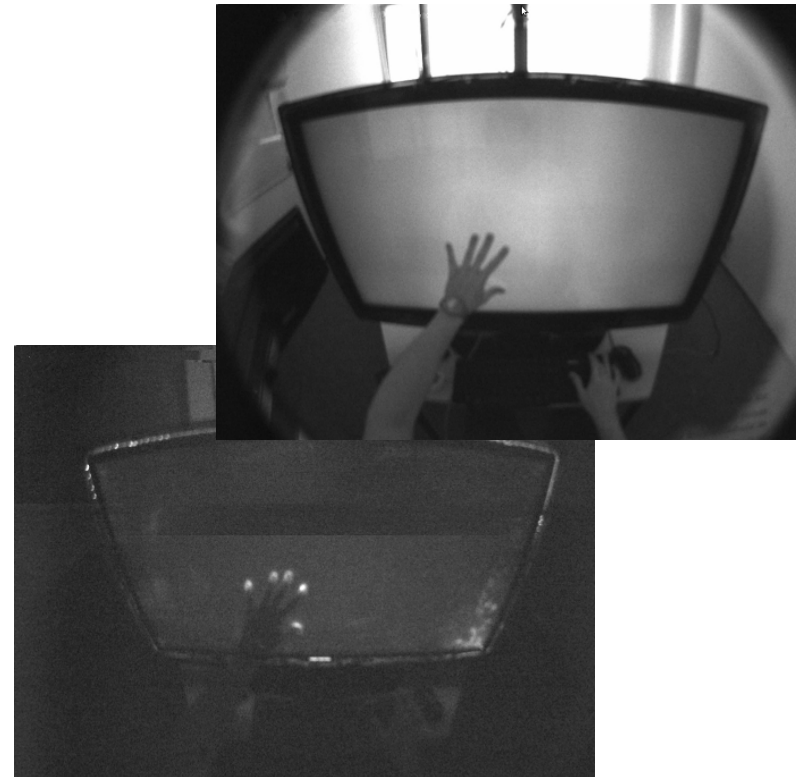
aluminium
frame



Discussion

Outlook & Improvements

- lower contrast than regular FTIR:
- mitigated by synchronized illumination
- main problem: occlusions by other hand
- possible solution: multiple cameras
- extension: dual-mode tracking
- fiducial or hover detection possible



Reference: *Shadow Tracking on Multitouch Tables*. F.Echtler, M.Huber, G.Klinker. ACM AVI 2008, Naples, Italy.
A Short Guide to Modulated Light. F.Echtler et al. ACM TEI 2009, Cambridge, UK.

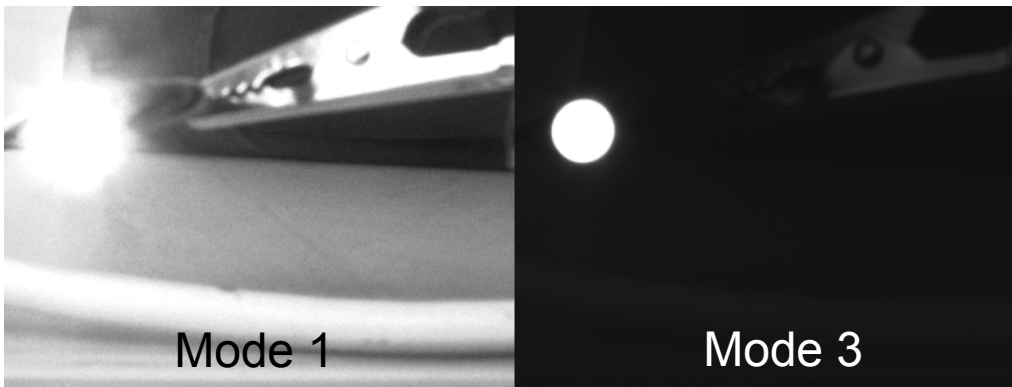
Thank you for your attention!

Questions & Comments?

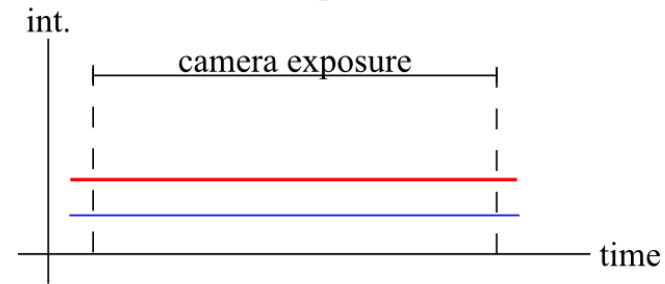
Hardware Details

Synchronized IR Illumination

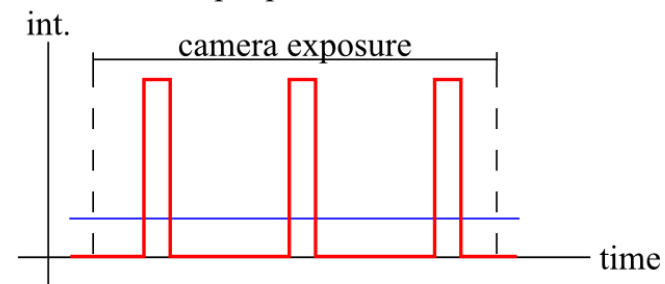
- always a problem with camera-based systems: ambient light
- sun/fluorescents emit large amounts of IR light across a wide spectrum
- possible solution: synchronized illumination
- LEDs flash $\sim 200 \mu\text{s}$ \rightarrow high brightness
- camera exposure adjusted accordingly



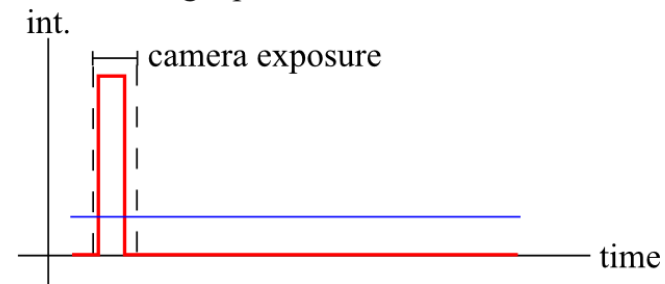
Mode 1: continuous operation



Mode 2: multiple pulses



Mode 3: single pulse



— ambient light
— IR light from LEDs