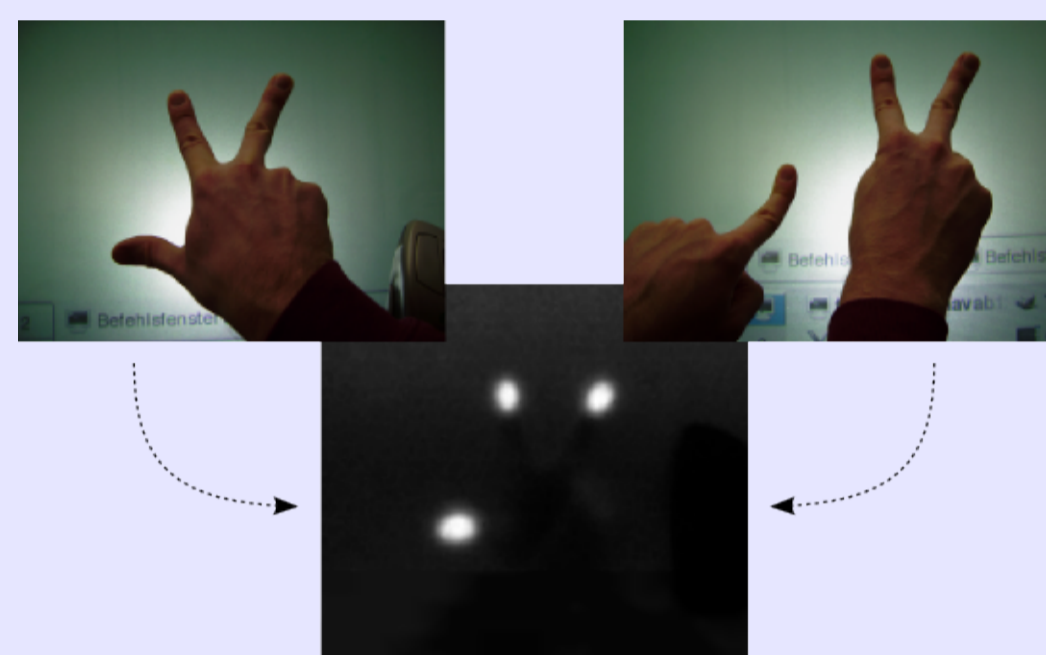


Shadow Tracking on Multi-Touch Tables

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Questions for FTIR-based Multitouch

- Where is the user?
- Who is it, anyway?
- Which finger is it?
- Where's that object?



Existing Approaches

- DiamondTouch: identify users via specific signal
 - Advantages: unambiguous differentiation between persons
 - Drawbacks: physical connection needed
- „zero-force“ FTIR
 - Advantages: FTIR effect can be triggered by objects
 - Drawbacks: small objects and fingers difficult to distinguish
- SmartSkin: capacitive sensing
 - Advantages: hover effect and hand shape detection
 - Drawbacks: only conductive objects can be tracked, no unambiguous differentiation between touch and hover

Proposed Solution: Shadow Tracking

Hardware Setup

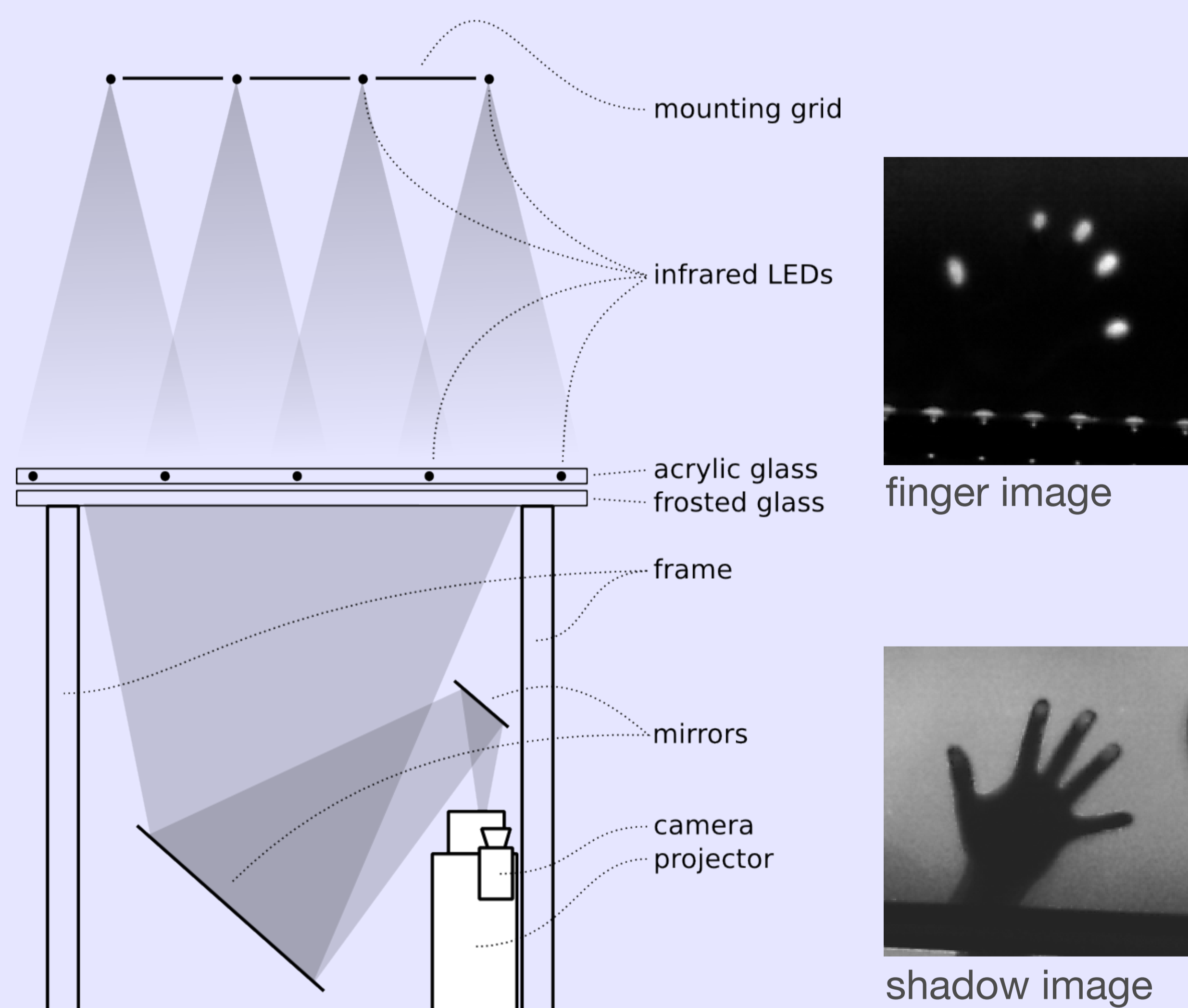
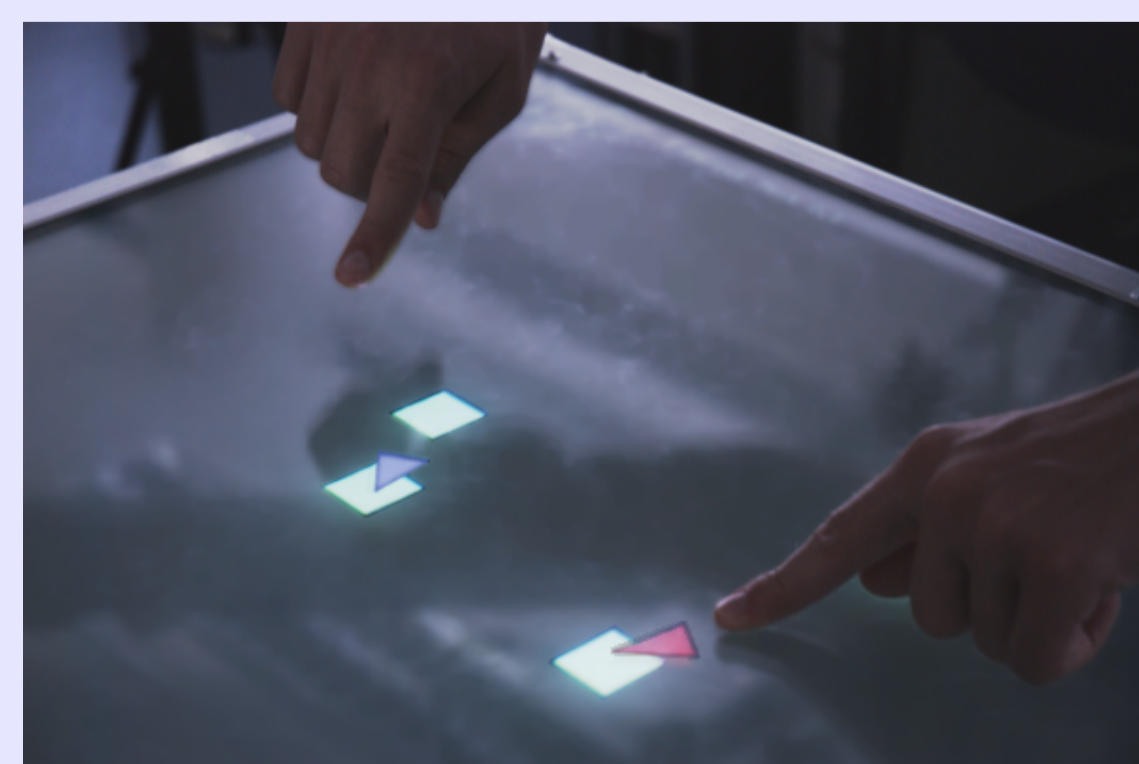


Image Acquisition and Processing

- 2 sets of LEDs: top for shadow, side for finger
- Lighting alternates between odd and even frames
- Drawback: effective framerate reduced by 50%
- LEDs are synchronized to 60 Hz camera frame rate
- Driven by single high-current pulse for each frame
- Camera shutter duration has same length as pulse
 - ⇒ high contrast with respect to environment light
- Pixel-level operations for both images:
 - Background subtraction
 - Thresholding with fixed value
 - Denoising (Erosion)
 - Mask generation
 - Background update
- Image-level operations: calculate..
 - Centroid
 - Major/minor axis
 - Peak/Point-Of-Interest

Other Applications

- Pointer Control (Hovering)
- Object Tracking
- Authentication
- [your idea here]



References

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- A. Wilson. *TouchLight: an imaging touch screen and display for gesture-based interaction*. ICMI '04.
- J. Rekimoto. *SmartSkin: an infrastructure for freehand manipulation on interactive surfaces*. CHI '02.