Two-Finger Input with a Standard Touch Screen

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Demo

Do this with a standard four-wire touch screen:

- Paint
- Whole-hand selection
- Disk scratching
- Pan, zoom, rotate
- Rotary knobs (debatable)
Related Work

- Midpoint output of standard touch screen
- Capacitive sensing
  - SmartSkin, Diamond Touch, iPhone
- Camera(s) behind
  - Frustrated total internal reflection, TouchLight, Surface
- Cameras in the bezel
  - LG.Philips, NextWindow
- Light sensors at every pixel
  - Sharp, Toshiba Matsushita, Planar Systems
- Many active IR sensors
  - ThinSight
- Touch from behind
  - LucidTouch
Hardware

- Measure a variety of resistances and voltage drops among the four wires
- Arduino controller
- USB to PC (serial port)
Measurement of Extent

- Simultaneous or extended touches reduce the resistance across the panel
- Measure the change in voltage across the panel \( V_R - V_L \). Resistors needed!

\[ \text{Diagram showing measurement setup with fingers on touch screen.} \]

- Single/multiple touch disambig.
- Similarly for \( y \)
Measurement of Position

- Similar to standard operation of a four-wire touch panel (but reference to $V_R - V_L$)
- Apply a voltage across and measure the voltage drop at the remaining wires
- For several simultaneous touches: average of positions

- Similarly for $y$
Measurement of Pressure

- Pressure reduces inter-layer contact resistance
- Also needed to detect presence of finger
Angle Disambiguation

- The x and y extents do not differentiate between:

- Look at $V_T - V_B$ with a voltage applied across
Options and Limitations

- No precise two locations for small pressure
- Extent increases with pressure

- Voluntary ping-pong by pressure balance?
- Issues for applications:
  - Only minor issue for rotation control
  - Zoom control and selection growth by pressure?

Video
Conclusion

- No projector, no camera: inexpensive, portable, handheld
- Retrofit to existing touch panels
- Accuracy acceptable for a range of applications
- Pressure balancing as new interaction mode