EE16A Touchscreen 2

TA, ASE, ASE, ASE
Last Week: Soldering

- Building the base of the resistive touchscreen
- Resistors in parallel and in series
- Breadboarding!
This Week: Resistive Touchscreen

- Investigate a resistive touchscreen
  - Something cool that actually was used for a long time!
- Use voltage as a signal to determine position of touch
  - How?
Resistive Touchscreen

- Physical touch results in physical contact between top and bottom layers
- Voltage dividers allow us to compute touch location

EX: Nokia N900, Nokia N97 Mini, LG Optimus, LG GW620, Nintendo DS

Resistive touchscreen
Tools for Today:

- Power Supply
  - Always set a current limit! (0.1 A)
- Multimeter - measuring device
- Launchpad - measuring device
- Voltage dividers
  - How we will detect location
Touchscreen Theory (Note 13/14)

● What’s the voltage at the top?

● What’s the voltage at the bottom?

● Voltage at u2?
Touchscreen Theory (Note 13/14)

- Voltage divider:

\[ u_2 = V_s \cdot \frac{kR_1}{kR_1 + R_1} \]

\[ u_2 = V_s \cdot \frac{R_1(k)}{R_1(k + 1)} \]

\[ u_2 = V_s \cdot \frac{k}{k + 1} \]

Independent of the value of R!
Build it up

- What are the voltages at \( u_2 \) and \( u_3 \)?

\[
\begin{align*}
  u_2 &= V_s \frac{k}{k+1} \\
  u_3 &= V_s \frac{k}{k+1}
\end{align*}
\]

- What’s the voltage difference?

The Rs cancel out! All the matters is the proportion between the top and bottom resistors. In fact, \( u_3 \) and \( u_2 \) are at the same voltage.
We know that $u_2 - u_3 = 0$

How much current goes through $R_3$?

$$u_2 = V_s \times \frac{k}{k + 1}$$

$$u_3 = V_s \times \frac{k}{k + 1}$$
Building it up

- Add one more resistor divider...
- We get our touchscreen!
Resistive Touchscreen - 2 Layers

Bottom Layer: Resistive Layer
Resistive Touchscreen - 2 Layers

Top Layer:
Flexible Resistive Layer
What’s The Difference?

- Nothing
  - The ink is a bunch of resistors
    - The resistor values don’t matter because we showed only the proportions matter for this circuit
  - Their circuit diagrams are the same
- One is flexible so we can actually move it to make contact
- We use two so that we can measure with one and apply voltage to the other without changing our circuit. More on this in the next slides
Actually Computing a Location

- Measure some voltages, compute location based on value
- Can you find any two horizontal locations that would output the same voltage?
- What about vertical?
Actually Computing a Location

- We can only get a solution vertically.
- What about the other dimension?

What if we turned it sideways?
Actually Computing a Location

- Let’s turn it sideways
  - Apply voltage so we power the horizontal direction
  - Find “vertical” location in horizontal orientation
- This gives horizontal location
Actually Computing a Location

- If we take two readings, one in each dimension can uniquely determine our location in 2D
- More on this in the lab
Taking the Limit

- 9 touch points is kinda meh
- How do we get more?
Taking the Limit

- Add more resistors!
Taking the Limit

- But what if I don’t want to increase the size of the circuit
  - Add more, but make the resistors smaller!
- What happens as the resistors approach infinitely small sizes?
  - Isn’t that just a resistive sheet?
  - This is how all resistive touchscreens work
Notes

- Make sure **ink side** of the plastic film is **facing down** towards the resistors
- There are coordinates on the PCB (**use them**)
- Foam blocks and film are on the TA desk
- Make sure you close serial monitor before running the ipython code
- Read **carefully** for which coordinates you should be connecting the multimeter and the power supply to
  - One wire will be free & 3 wires will be in use