

User Interfaces and Industrial IoT, Hands-On

Class 2: Simple Interfaces That Aren't So Simple

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This Week's Agenda

- 2/26 An Overview of IIoT Applications and Interface Needs
- 2/27 Simple Interfaces that Aren't So Simple
- 2/28 Beginning Graphics Interface, Hands-on (Part 1)
- 3/1 Beginning Graphics Interface, Hands-on (Part 2)
- 3/2 Advanced Human Interface design for the IIoT

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2/27 **Simple Interfaces that Aren't So Simple**

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Switches

- Simplest form of input
- Can be a single, a gang, or a matrix keyboard
- Common types
 - Electromechanical
 - Membrane
 - Touch sensor

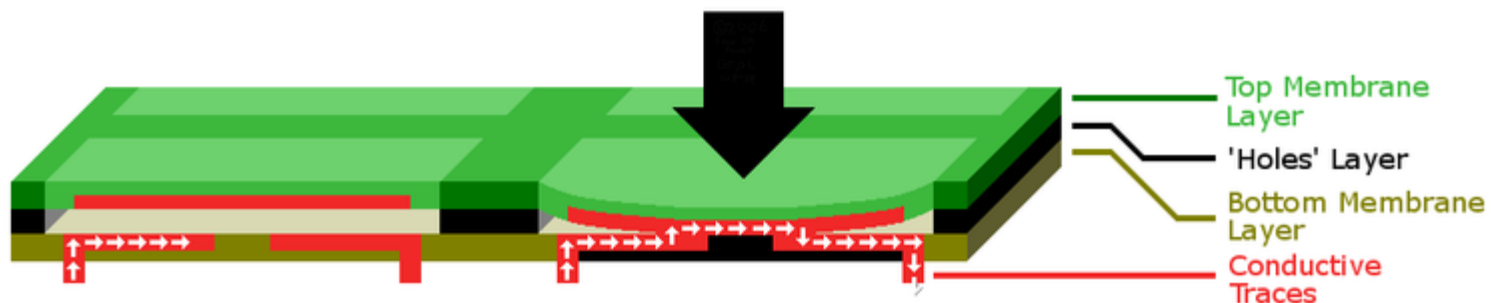
Mechanical Switches

- Cheapest in small quantities
- Can be made for harshest environments
- Wear out over time



Membrane

- Can be custom made
- Top layer can be made chemical resistant
- Durability issues
- High cost for small quantities



Touch Sensor



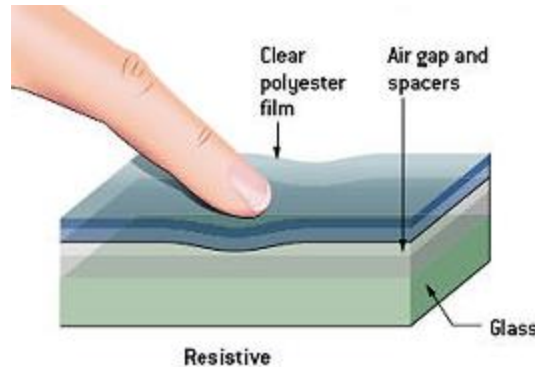
Question 1: What other issues can you think of for touch pads?

Touch Screen



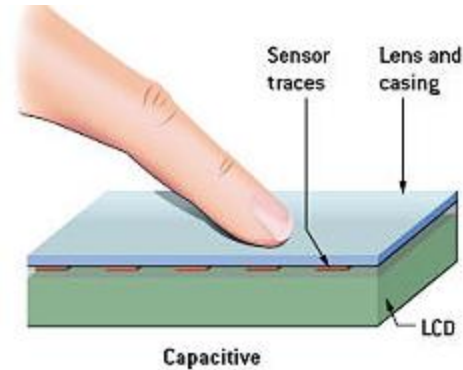
Presented by:

Resistive vs Capacitive



Resistive

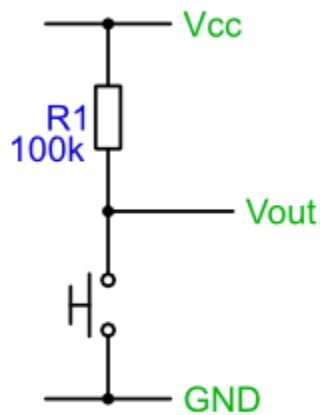
- has a flexible plastic cover
- Single point only
- Better for gloved hands
- Slightly cheaper



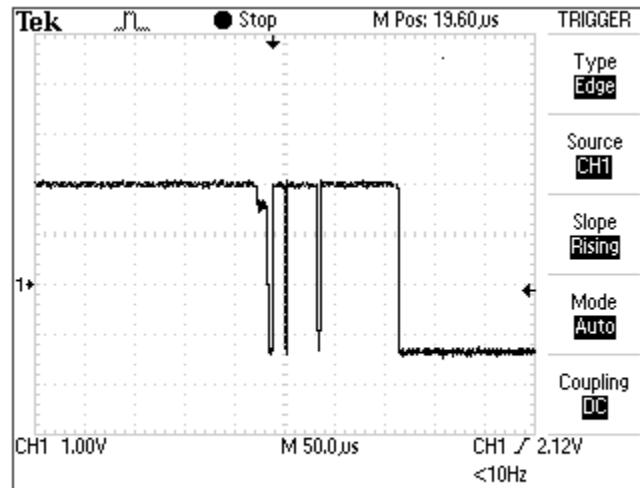
Capacitive

- is more popular
- has a glass top cover
- Allows two-touch
- Cut resistant
- Can shatter

Switch Bounce



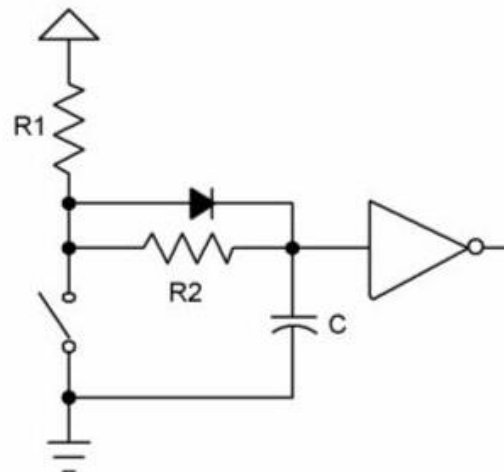
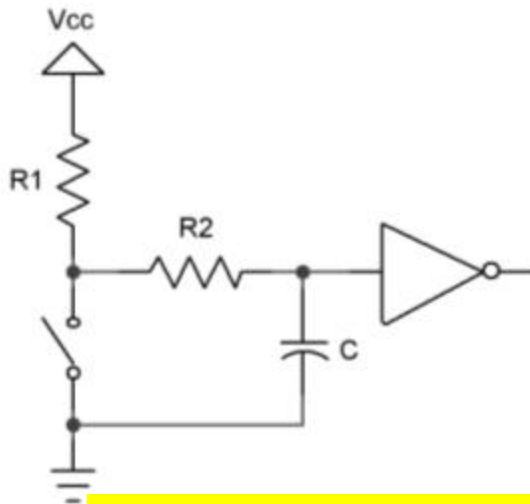
Simple switch pull-up circuit



Switch bounce produced on switch press

Resolving Bounce

- Add an R-C circuit to dampen transitions
- Sample input over time to remove 'bounces'
- Use edge detection interrupt



Question 2: Can we eliminate R2? Why or why not?

Alphanumeric LED/LCD Modules

Olmex 1188-1134-ND

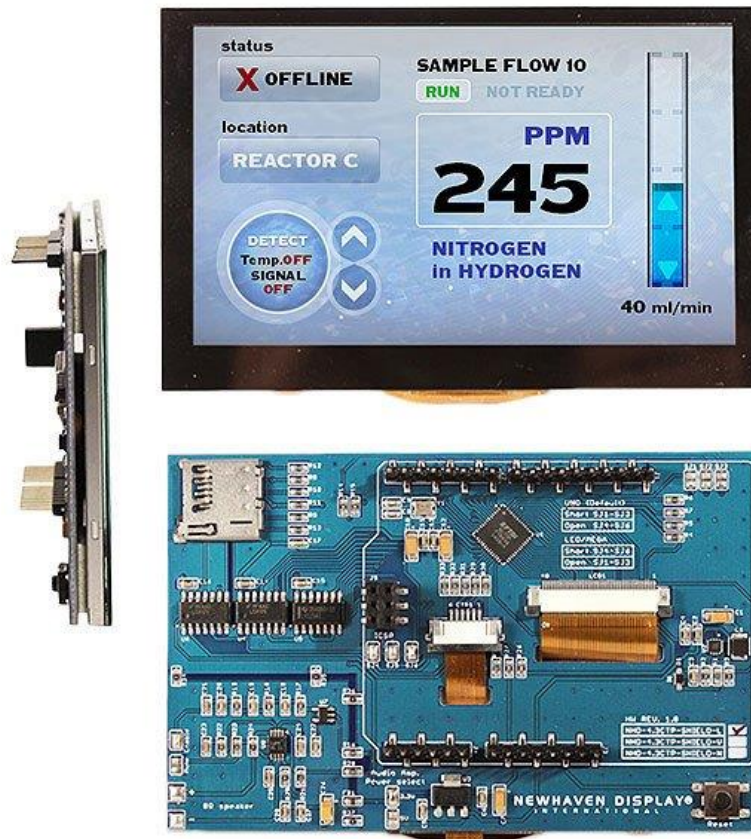


- Pre-packaged for easy prototyping
- Easy integration with even small microcontrollers
- 4 or 8 bit bus plus control
- Can even come with switches

LCD Panels

- Available with and without touch overlays
- Costs have come down
- Small panels are getting on par with the alphanumeric modules in quantity
- Flexibility in production sizes:
 - Panels with integral controller for smaller quantities
 - LCD and graphics-capable microcontroller in larger quantities

Add-on Panels



Integrated LCD Processor

- Our example this week is the NXP LPC54608
- Available on a low-cost demo board with a 4.3" 480x272 TFT, capacitive touch display
- Board includes USB, PMOD, plus Arduino and additional I/O as well as built-in JTAG

OS or not OS

- Graphics application development can differ greatly between using a smaller microcontroller such as a Cortex-M3/4 with no operating system (OS) or a larger processor such as an A7/9 and an OS such as linux.
- Whereas there are many graphics packages for linux, we need to look at separate graphics development packages for the more limited M3/4 chips

Some Popular Graphics SW

- Segger emWin (\$6-12K)
- Draupner TouchGFX (\$6K)
- PEGPlus/Pro (\$7-7.5K)
- Others
- Keil includes a graphics library with their Pro edition
- We will be using a demo version of TouchGFX

Question 3: What other graphics libraries are you familiar with?

Preparing for Tomorrow

- Download the TouchGFX demo and environment
<https://touchgfx.com/try-touchgfx/evaluation/>
- Download the demo of IAR EWARM (full 30-day) – go to
<https://www.iar.com/iar-embedded-workbench/#!?architecture=Arm>
- If you will not be using a board, you only need the TouchGFX software

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Please stick around as I answer your questions!

- Please give me a moment to scroll back through the chat window to find your questions
- I will stay on chat as long as it takes to answer!
- I am available to answer simple questions or to consult (or offer in-house training for your company)

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