

21M.370 Digital Instrument Design

Lab 7 - for Apr 9

This week we will be using copper tape to make a touch-sensitive instrument. There are three ways you can approach this: capacitive sensing using the MPR121 (recommended), conductive sensing, and capacitive sensing using the analog pins.

This lab doc contains everything necessary to do this assignment, and also contains links at the end to more information than you will ever need about designing capacitive sensing systems.

Your primary resource for this assignment is videos on the youtube playlist which go through the different touch sensing options:

[MPR121 getting started](#)

[Capacitive sensing in Python/PD](#)

- also shows how to use capSense using the ESP32 analog inputs

[Conductive sensing](#), including making a simple automatonism patch.

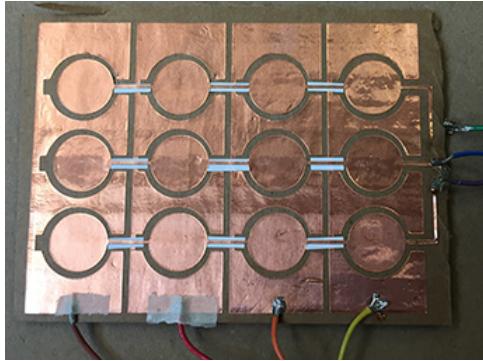
I'll post more example videos in the next few days.

Assignment goals

1. Use the copper tape to make some sort of interface.
2. Hook up the MPR121 (recommended, and covered in the videos)
 1. alternatively use conductive sensing or capSense using the ESP32
3. Copy and modify an existing Automatonism patch to use capSense data.
4. Record a 60-90s video of yourself playing your instrument.

Examples of capacitive interfaces:

MIT 4.140 EXAMPLE



PROSTHETIC INSTRUMENTS
[HTTPS://YOUTU.BE/THSOO8BOAQA](https://youtu.be/THSOO8BOAQA)



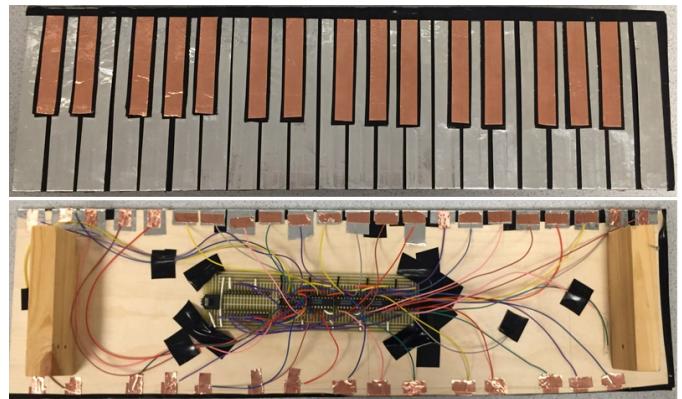
CRACKLEBOX



SNYDERPHONICS MANTA



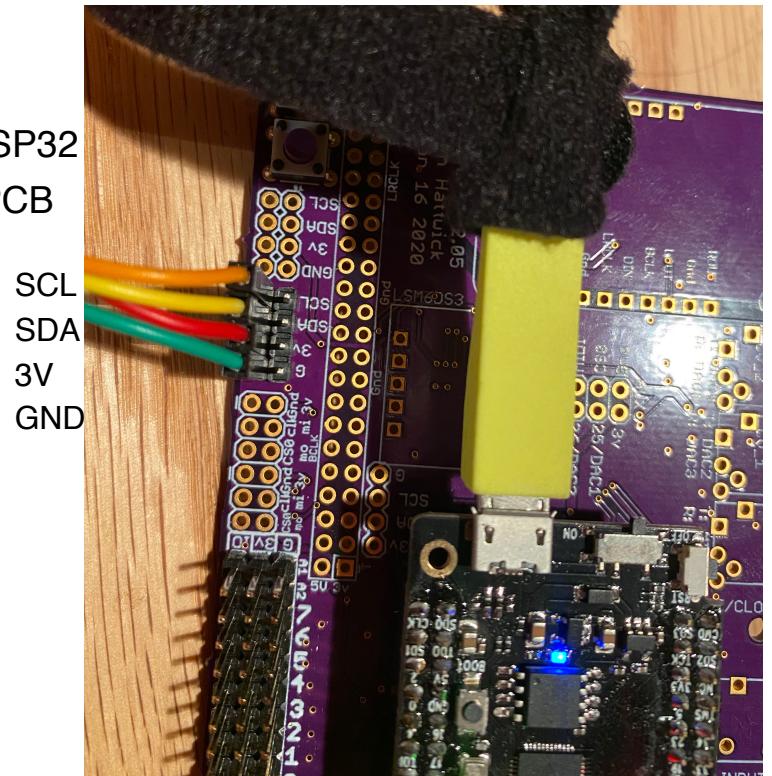
MISC TOUCH KEYBOARD



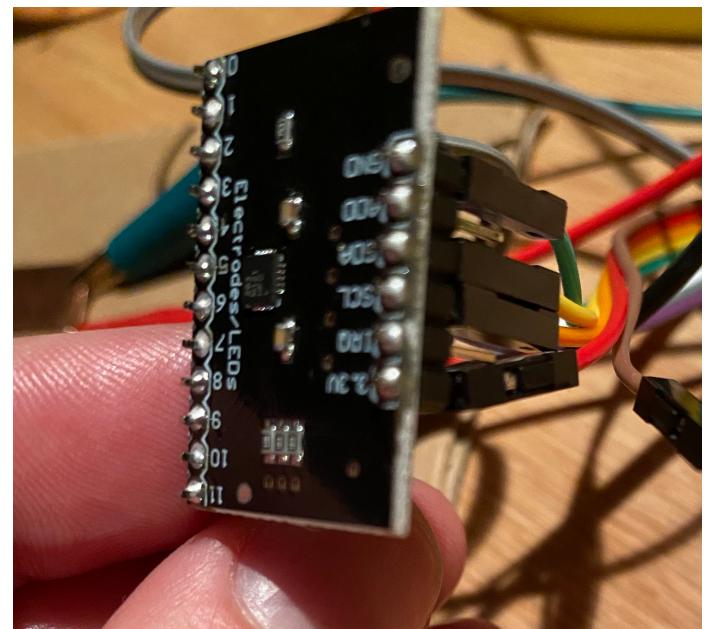
Hooking up the MPR121

1. Connect and test MPR121 and ESP32

1. Solder I2C headers on m370 PCB
 - 4 I2C headers are available on the m370 PCB
 - you only need one group of 4
 - might as well solder at least two I2C headers though



2. Solder headers on MPR121 breakout board

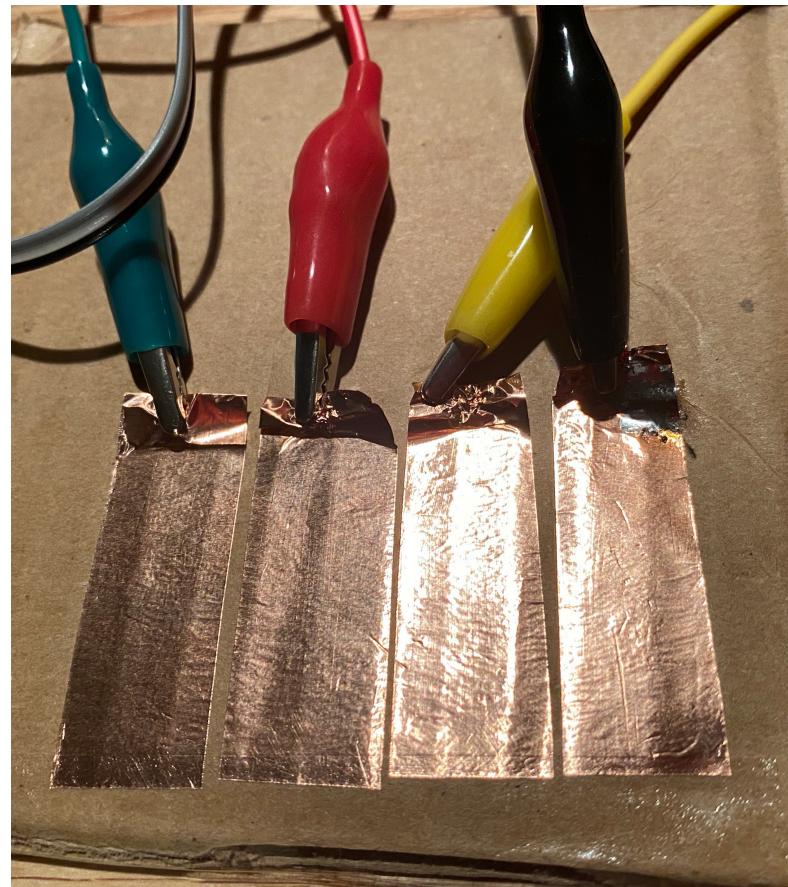


3. Connect cables from MPR121 to m370 PCB
 - you only need to connect 4 cables

MPR121	m370 PCB
3.3v	3v
GND	G
SDA	SDA
SCL	SCL

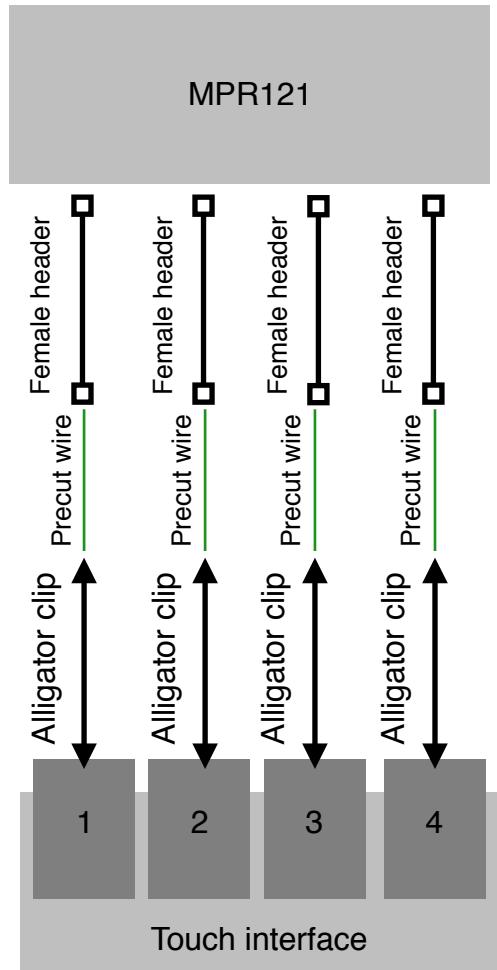
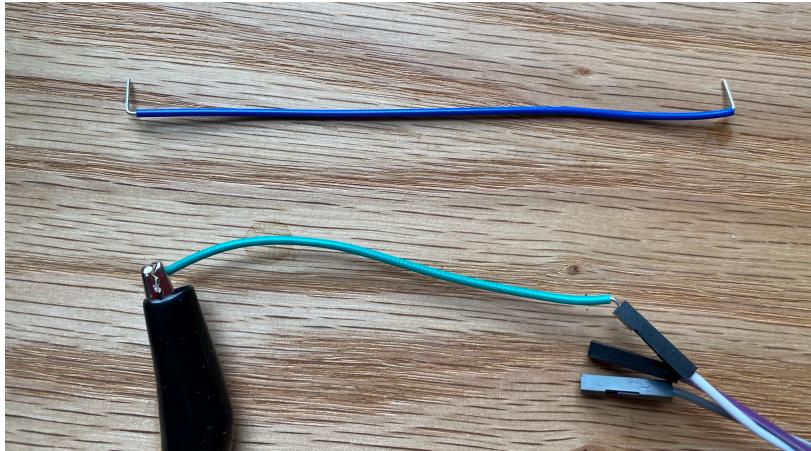
4. Open 'M370_CAPACITIVE' to ESP32
 1. uncomment line 94 'MPR121test()'
 2. Upload 'M370_CAPACITIVE' to ESP32
 3. Open arduino serial monitor to see capSense data
 4. if data is all 0's, check your wiring and solder joints
 5. you can also try resetting the ESP32 by clicking its RST button

2. Use copper tape to make an interface
 1. Any shape / configuration will work as long as pads are not touching each other
 2. make a tab by folding the tape over to use alligator cables
 3. or you can solder a wire directly to the copper
 4. Watch out! Copper tape can be sharp! Use something rigid to smooth



out the tape, and especially the edges. Consider putting tape or plastic over the copper or at least the edges. (covering the copper will work with capacitive sensors but not with conductive sensors)

5. You can use the precut wires from your kit to go between the alligator clip and the female headers to the MPR121 or ESP32



Conductive Sensor

An alternative to capacitive sensing is conductive sensing. See the video for more, but here is a basic diagram of how to hook it up.

- once the circuit is hooked up, you will read just as if it was a photocell or other analog sensor

