

# 21M.370 Digital Instrument Design

## Lab assignment 5 - Due March 24 at 2:00pm

### **Deliverables:**

1. A link to a 1-2m video of you performing with an instrument using at least 6 capacitive sensors.
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### **Assignment description:**

This week we will be using copper tape or other metallic objects to make a touch-sensitive instrument. We will be using the MPR121 capacitive touch sensor over I2C for the capacitive sensing.

This lab doc contains everything necessary to do this assignment, and also contains links to more information. Your primary resource for this assignment is the videos on the youtube playlist.

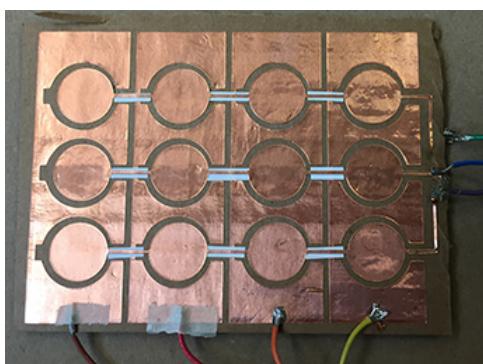
### **Assignment goals**

1. Use copper tape to make some sort of interface, or assemble other object you can clip alligator clips to.
2. Assemble the MPR121, connect to the ESP32, upload the capacit.ino firmware to the ESP32.
3. Run the capacit.py script and the main.pd and capacitCtrl.pd files
4. Experiment with the example instrument. You may need to tweak some of the values in the oscMapping.py file, depending on what you chose to use for sensors.
5. Modify the example instrument to use at least two more pads and map those pads appropriately.

6. You can use the capacit PD patches as-is, or you can modify them or make your own.
7. You will need to modify the Arduino sketch to use at least 6 capacitive sensors.
8. You are welcome to use additional analog or digital sensors, but all you need to use to complete the assignment is 6 capacitive sensors.
9. Record a 1-2m video of yourself playing your instrument.

### Examples of capacitive interfaces:

MIT 4.140 EXAMPLE



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



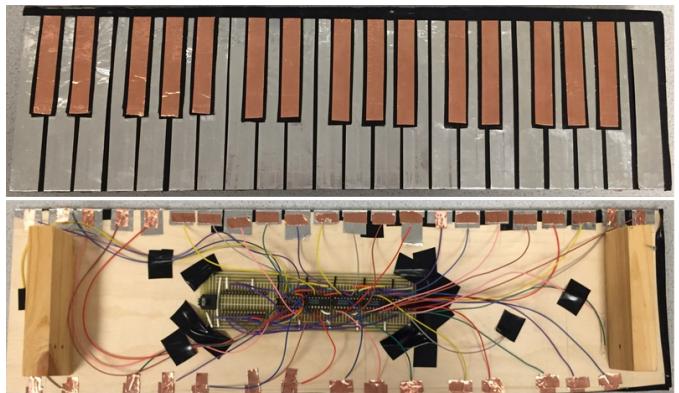
**CRACKLEBOX**



**SNYDERPHONICS MANTA**



**MISC TOUCH KEYBOARD**



## Video tutorials

1. Overview of musical capacitive sensing
  - including details on working with copper tape sensors
2. Technical description of analog, digital, and capacitive sensing
  1. The PD patch demonstrated is on the github: NIME/PureData/SensorTypes.pd
3. Soldering the MPR121 and connecting to the PCB
4. Getting started with the MPR121 software
  - includes description of how the Arduino file is organized, and how to change the number of inputs
  - also includes how to monitor capSense data in Arduino and in PureData
5. Overview of the Capacit instrument
6. Video demo of Capacit performance

## Links:

Capacitive Sensing Tutorials:

<https://create.arduino.cc/projecthub/akellyirl/just-veggin-with-an-arduino-beetbox-60fbea>

<https://programminginarduino.wordpress.com/2016/03/06/project-14/>

<https://pi.processing.org/tutorial/capacitive-touch-interface/>

Sequencers using CapSense:

<https://www.mengqimusic.com/voltage-memory>

<https://www.makenoisemusic.com/modules/rene-classic-legacy>

Keyboards and other controllers:

<http://www.verboselectronics.com/modules/touchplate-keyboard>

[http://people.ece.cornell.edu/land/courses/ece4760/FinalProjects/f2015/wj225\\_hj424\\_lw569/wj225\\_hj424\\_lw569/wj225\\_hj424\\_lw569/index.html](http://people.ece.cornell.edu/land/courses/ece4760/FinalProjects/f2015/wj225_hj424_lw569/wj225_hj424_lw569/wj225_hj424_lw569/index.html)

<http://instrumentslab.org/research/touchkeys.html>

<https://www.snyderphonics.com/manta.htm>

<https://www.researchgate.net/publication/>

[268381047 Snyderphonics Manta Controller a Novel USB Touch-Controller](#)

Other capacitive sensing techniques

<https://embedds.com/arduino-based-capacitive-liquid-sensor/>

<https://admarschoonen.github.io>

<https://learn.adafruit.com/plush-game-controller>

## Using 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)

