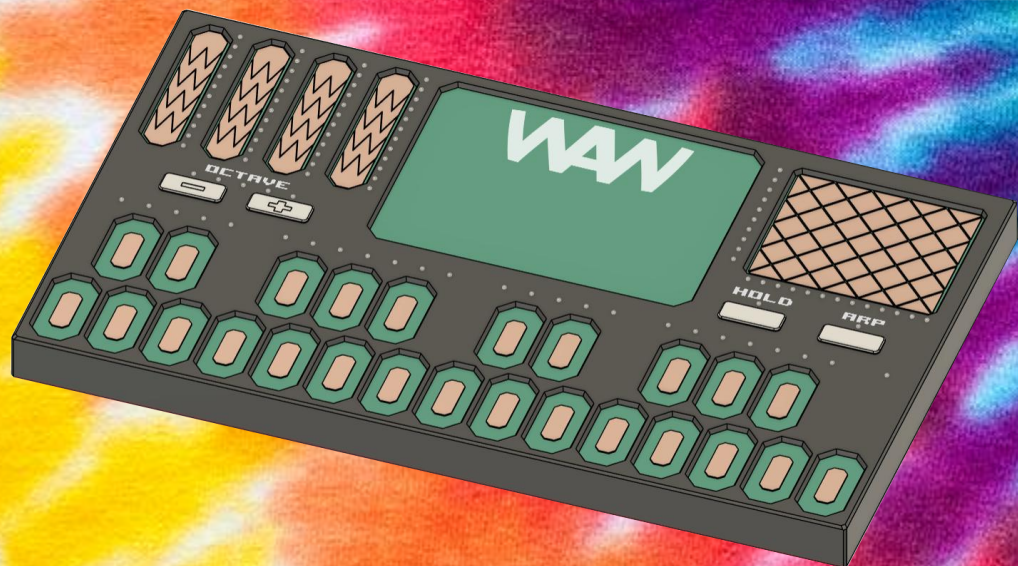


TERRITORIAL ACKNOWLEDGEMENT

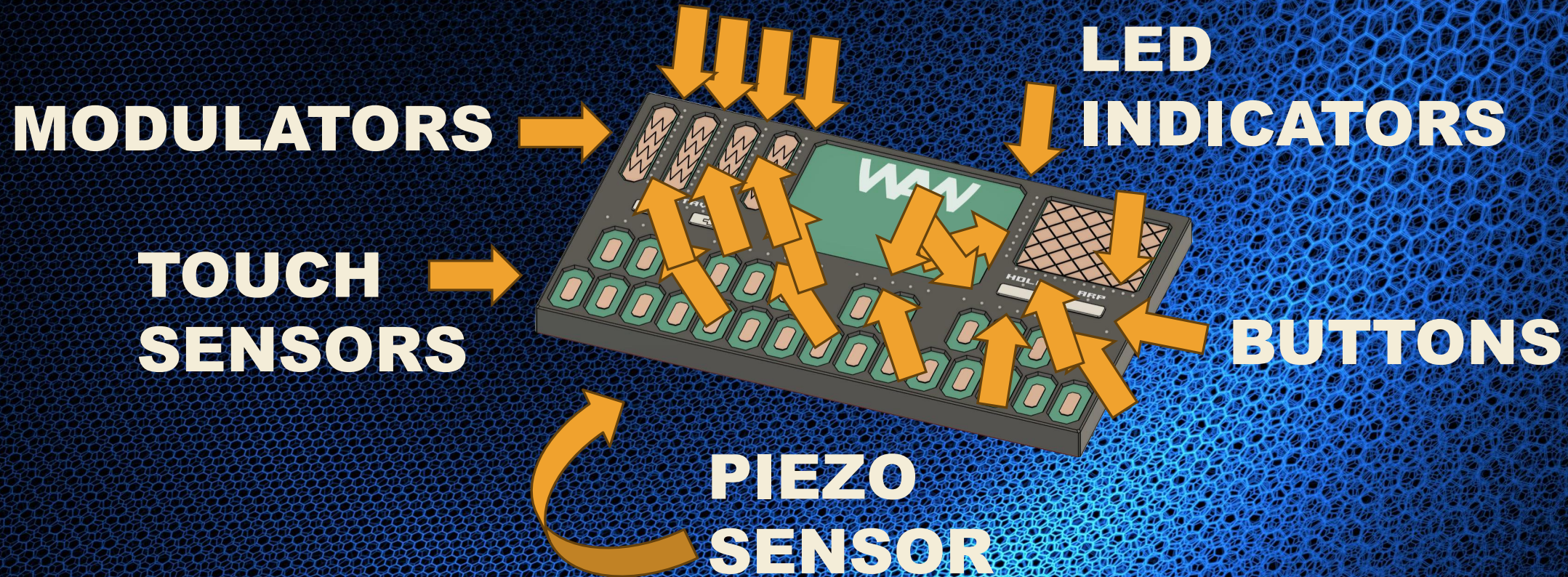
Camosun College serves the communities of southern Vancouver Island and the southern Gulf Islands that are located in the territories of the Ləkʷəŋən (Songhees and Kosapsum), Malahat, Pacheedaht, Scia'new, T'Sou-ke and W̱SÁNEĆ (Pauquachin, Tsartlip, Tsawout, Tseycum) peoples.

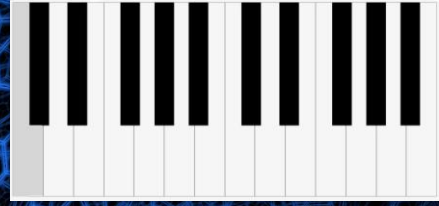
WAW



MTP – 25K

WHAT ARE WE COVERING?



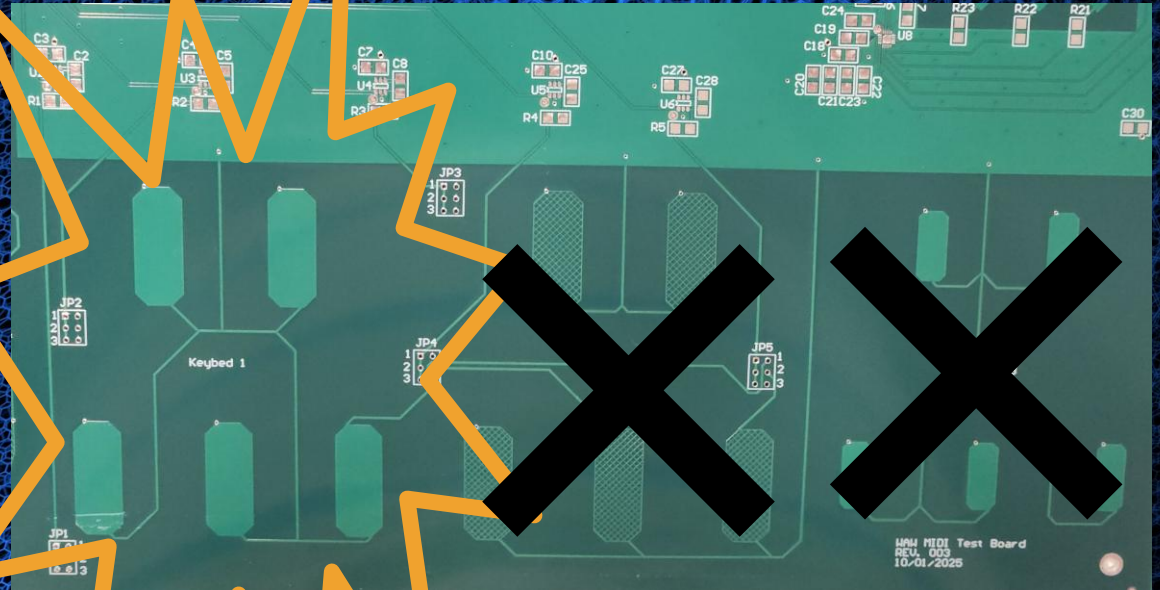
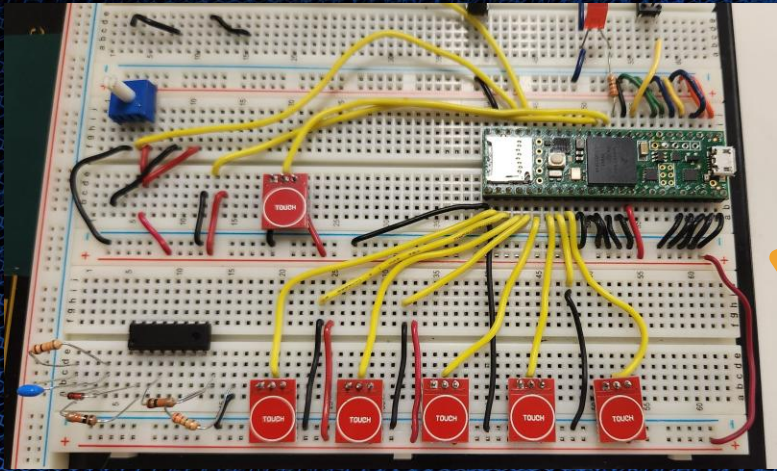
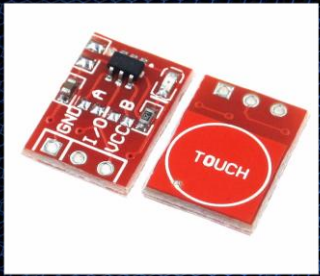
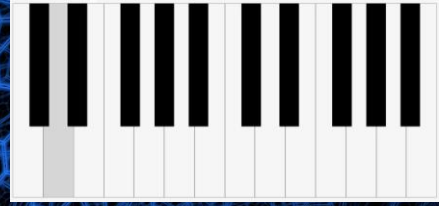


THEORY

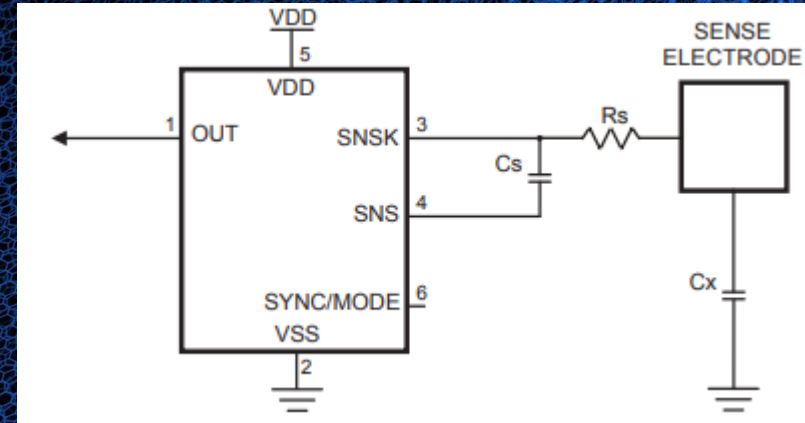
MIDI CHARLIEPLEXING I2C



EVOLUTION OF OUR: TOUCH SENSORS

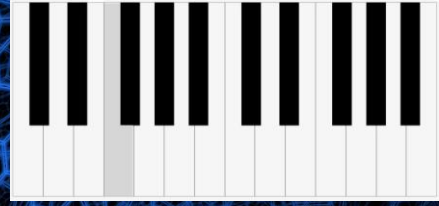


AT42QT1010 (SENSOR CHIP)

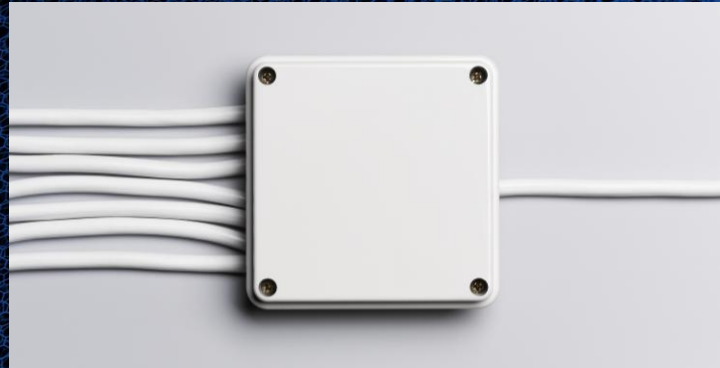


Designed for human interfaces
Pins 5 & 6 = Fast mode:
– keep pins high & Response speed is key

GPIO EXPANDERS



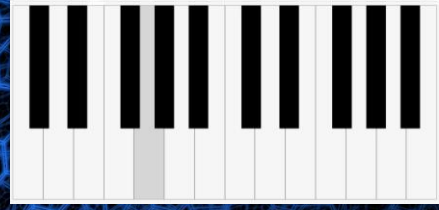
25 touch button pins



4 pins

Communicates over I2C

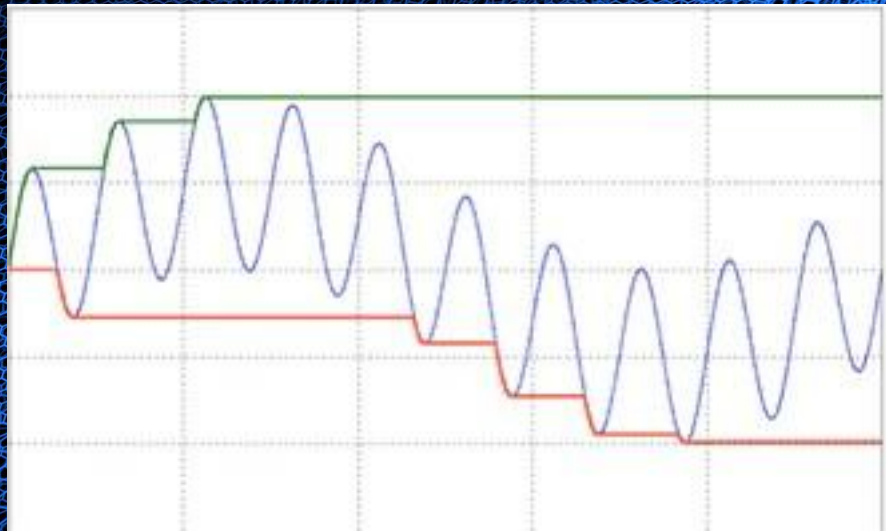
PIEZO SENSORS



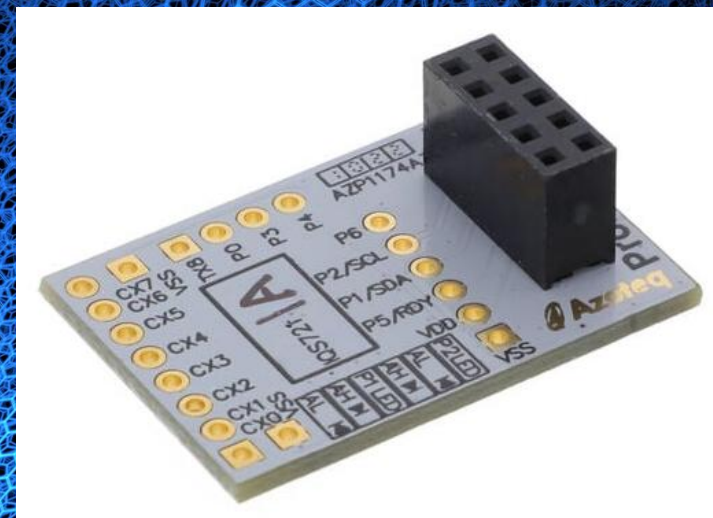
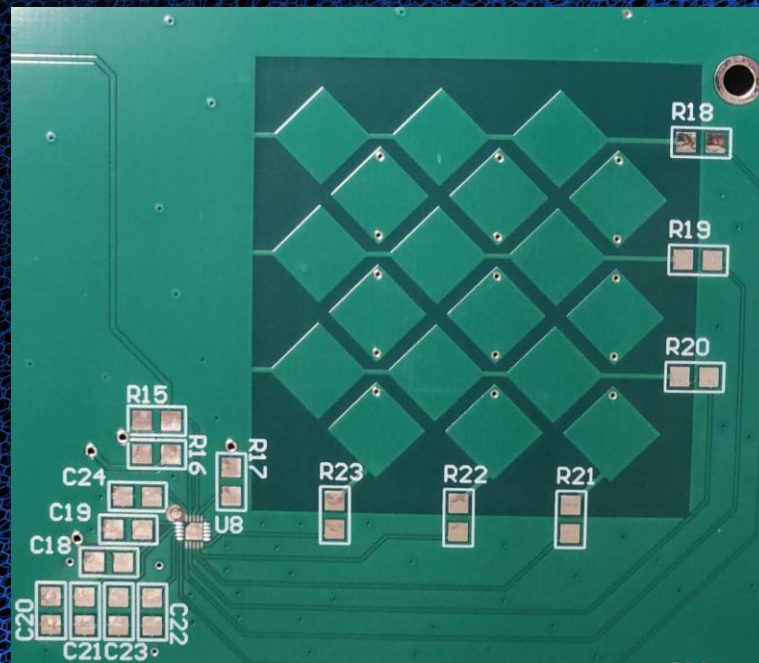
OR



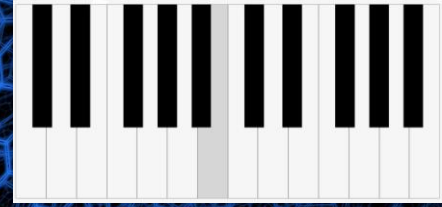
**PEAK
DETECTOR:**



MODULATORS

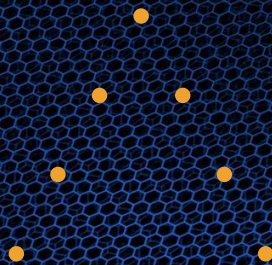


IQS7211AEV01

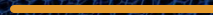


WHAT DO THE BUTTONS DO?

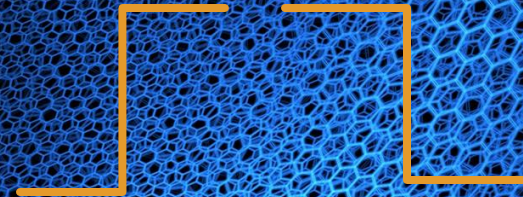
ARPEGGIATOR



HOLD



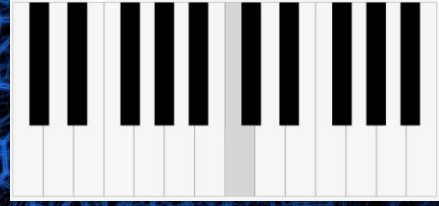
OCTAVE UP/ DOWN



SHIFT



LED INDICATORS



RUN LEDs IN SERIES?



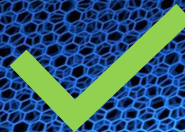
**TOO EXPENSIVE FOR
OUR POWER BUDGET**

MATRIX?



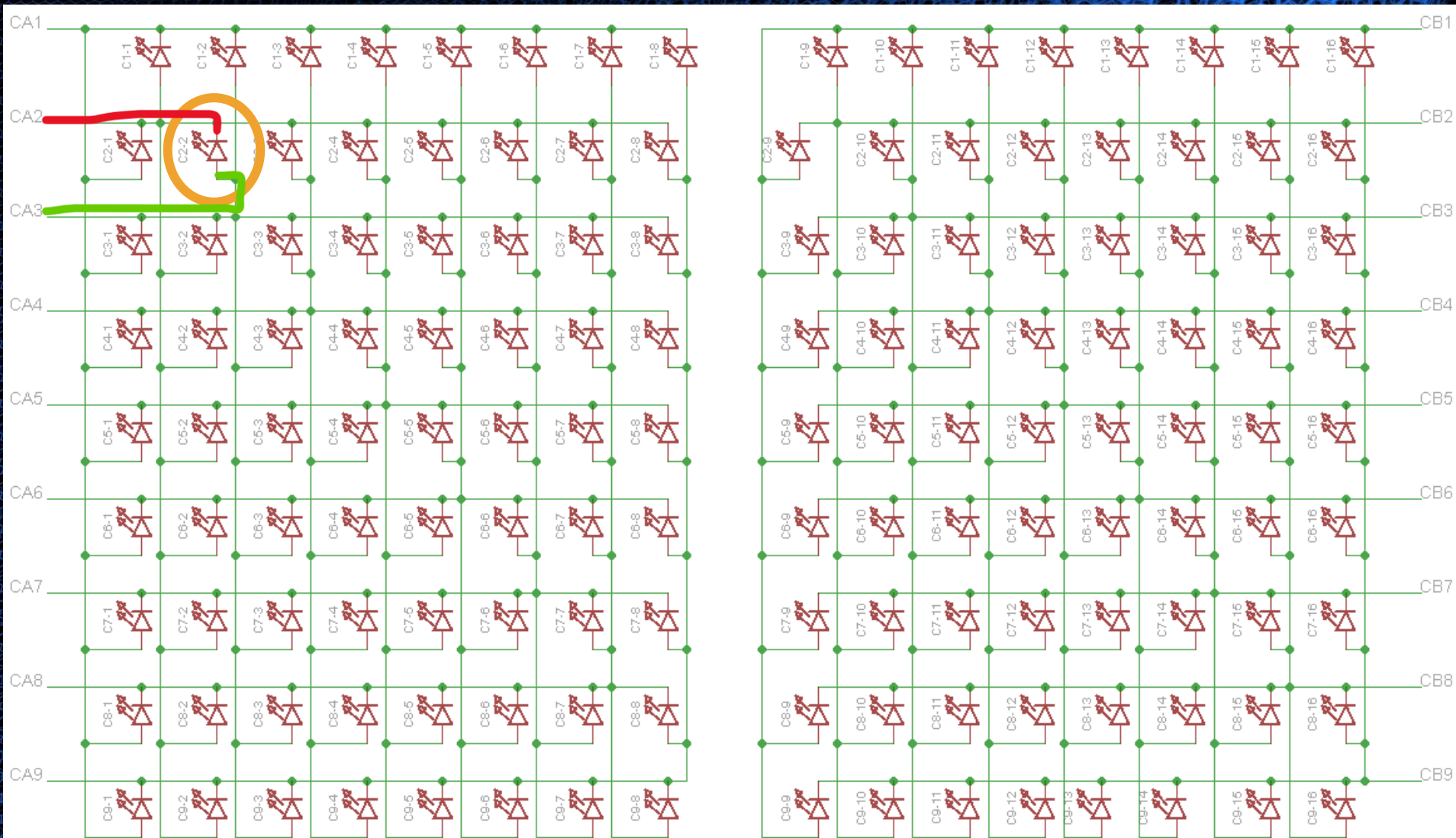
NOT ENOUGH PINS

CHARLIEPLEXING?



**- ENOUGH PINS
- FITS THE BUDGET**

CHARLIEPLEXING



HARDWARE INTERACTIONS

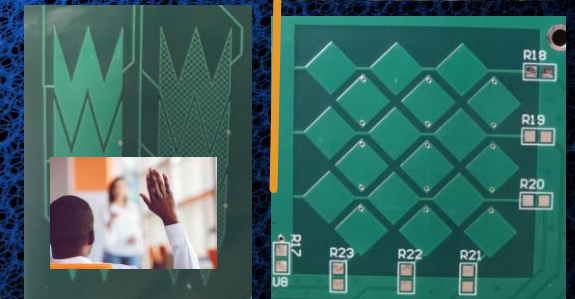
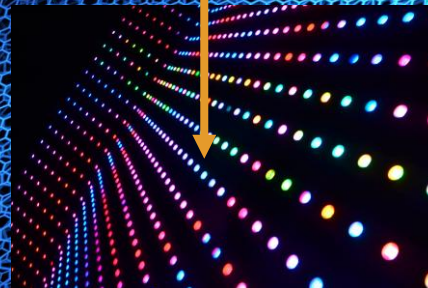
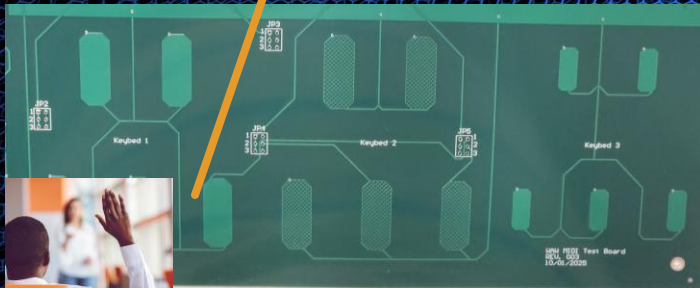
STEM

TEACHING

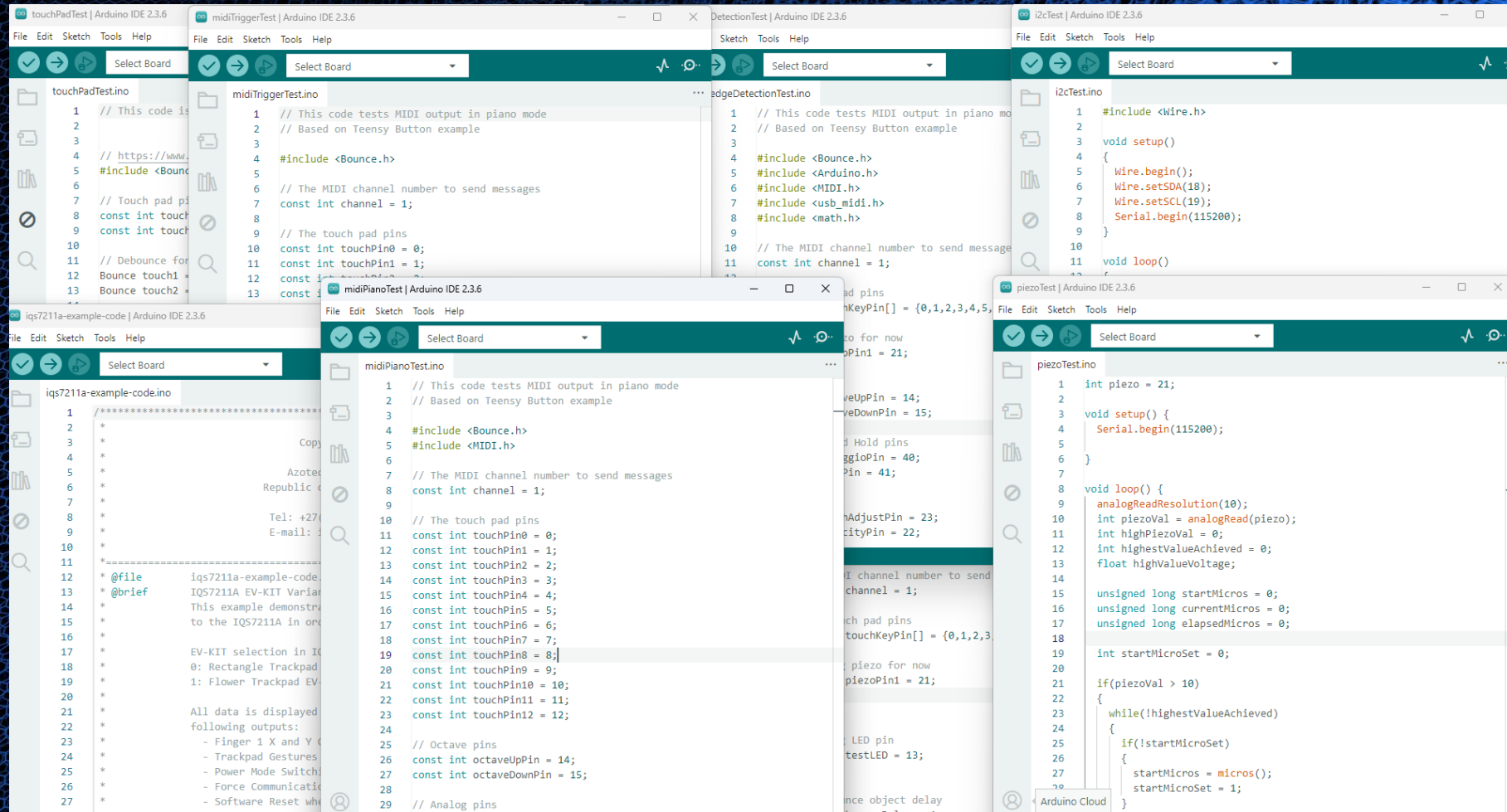
MCP23017
(GPIO
EXPANDERS)

IS31FL3731
(CHARLIEPLEXOR)

IQS7211
(MODULATION
SURFACES)



TEST CODE



The image displays a collage of several Arduino IDE 2.3.6 windows, each showing a different test code snippet. The windows are arranged in a layered fashion, with some overlapping others. The code snippets are as follows:

- touchPadTest.ino**:

```
1 // This code is
2
3
4 // https://www.
5 #include <Bounce.h>
6
7 // Touch pad pins
8 const int touchPin0 = 0;
9 const int touchPin1 = 1;
10
11 // Debounce for
12 Bounce touch1 = Bounce(touchPin0);
13 Bounce touch2 = Bounce(touchPin1);
```
- midiTriggerTest.ino**:

```
1 // This code tests MIDI output in piano mode
2 // Based on Teensy Button example
3
4 #include <Bounce.h>
5
6 // The MIDI channel number to send messages
7 const int channel = 1;
8
9 // The touch pad pins
10 const int touchPin0 = 0;
11 const int touchPin1 = 1;
12 const int touchPin2 = 2;
13 const int touchPin3 = 3;
```
- edgeDetectionTest.ino**:

```
1 // This code tests MIDI output in piano mode
2 // Based on Teensy Button example
3
4 #include <Bounce.h>
5 #include <Arduino.h>
6 #include <MIDI.h>
7 #include <usb_midi.h>
8 #include <math.h>
9
10 // The MIDI channel number to send messages
11 const int channel = 1;
```
- i2cTest.ino**:

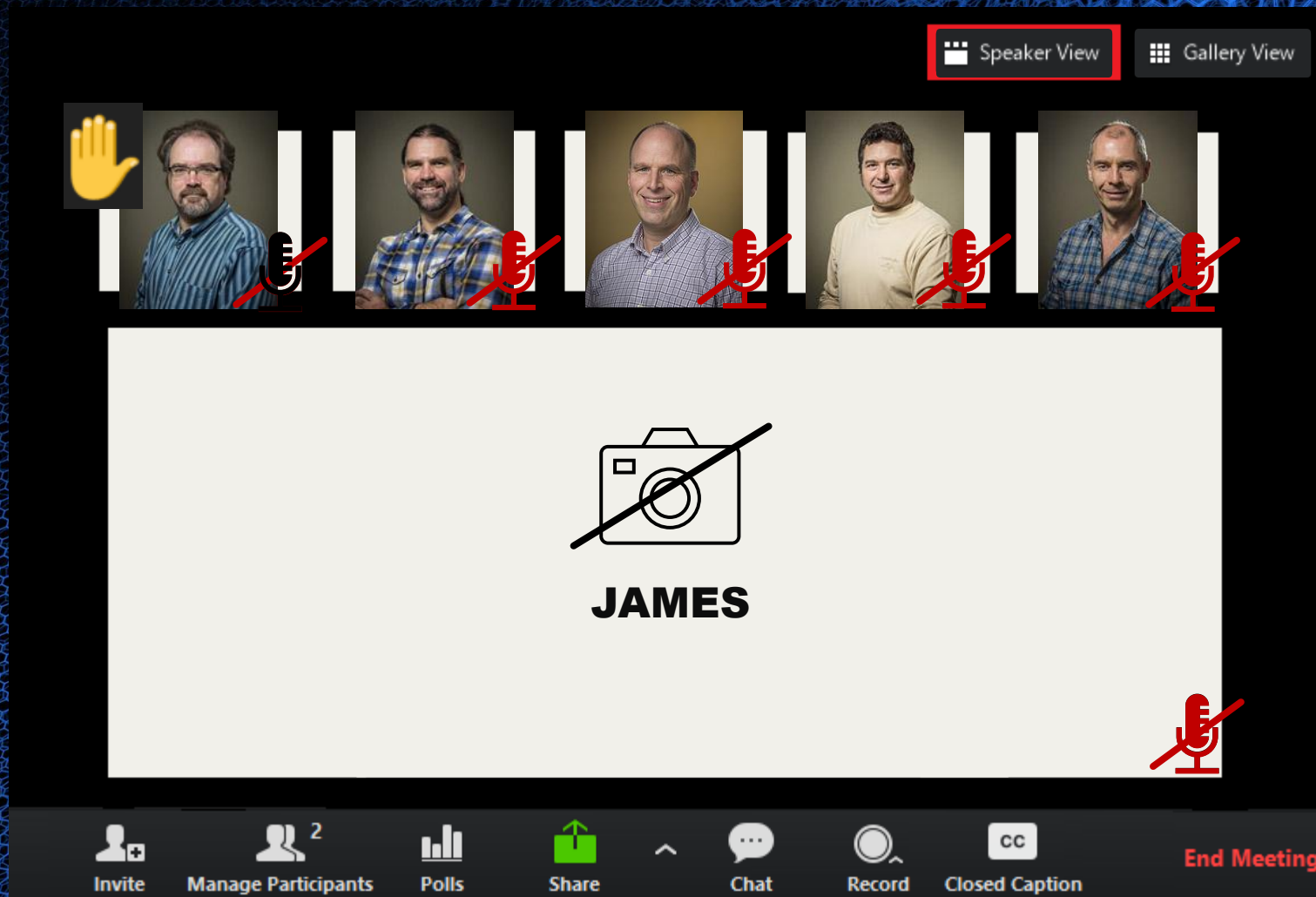
```
1 #include <Wire.h>
2
3 void setup()
4 {
5   Wire.begin();
6   Wire.setSDA(18);
7   Wire.setSCL(19);
8   Serial.begin(115200);
9 }
10
11 void loop()
12 {
```
- iqs7211a-example-code.ino**:

```
1 // *****
2 *
3 *
4 *
5 *
6 *
7 *
8 *
9 *
10 *
11 *
12 * @file iqs7211a-example-code.ino
13 * @brief IQS7211A EV-KIT Variator
14 * This example demonstrates
15 * to the IQS7211A in order
16 *
17 * EV-KIT selection in IQS7211A
18 * 0: Rectangle Trackpad
19 * 1: Flower Trackpad EV-KIT
20 *
21 * All data is displayed
22 * following outputs:
23 * - Finger 1 X and Y Coordinates
24 * - Trackpad Gestures
25 * - Power Mode Switch
26 * - Force Communication
27 * - Software Reset when
```
- midiPianoTest.ino**:

```
1 // This code tests MIDI output in piano mode
2 // Based on Teensy Button example
3
4 #include <Bounce.h>
5 #include <MIDI.h>
6
7 // The MIDI channel number to send messages
8 const int channel = 1;
9
10 // The touch pad pins
11 const int touchPin0 = 0;
12 const int touchPin1 = 1;
13 const int touchPin2 = 2;
14 const int touchPin3 = 3;
15 const int touchPin4 = 4;
16 const int touchPin5 = 5;
17 const int touchPin6 = 6;
18 const int touchPin7 = 7;
19 const int touchPin8 = 8;
20 const int touchPin9 = 9;
21 const int touchPin10 = 10;
22 const int touchPin11 = 11;
23 const int touchPin12 = 12;
24
25 // Octave pins
26 const int octaveUpPin = 14;
27 const int octaveDownPin = 15;
28
29 // Analog pins
```
- piezoTest.ino**:

```
1 int piezo = 21;
2
3 void setup() {
4   Serial.begin(115200);
5 }
6
7
8 void loop() {
9   analogReadResolution(10);
10  int piezoVal = analogRead(piezo);
11  int highPiezoVal = 0;
12  int highestValueAchieved = 0;
13  float highValueVoltage;
14
15  unsigned long startMicros = 0;
16  unsigned long currentMicros = 0;
17  unsigned long elapsedMicros = 0;
18
19  int startMicroSet = 0;
20
21  if(piezoVal > 10)
22  {
23    while(!highestValueAchieved)
24    {
25      if(!startMicroSet)
26      {
27        startMicros = micros();
28        startMicroSet = 1;
29      }
```

I2C & INTERRUPTS



The image shows a Zoom meeting interface. At the top, there are two view options: "Speaker View" (highlighted with a red border) and "Gallery View". Below these, a horizontal gallery of five participant video thumbnails is shown. Each thumbnail has a red microphone icon with a slash over it, indicating that all participants have their microphones muted. To the left of the first thumbnail is a yellow hand icon. The main video area below the gallery is white and contains a large camera icon with a diagonal slash over it, indicating that the camera is disabled. Below the camera icon, the name "JAMES" is displayed. At the bottom of the interface is a toolbar with several icons: "Invite", "Manage Participants" (with a "2" next to it), "Polls", "Share", "Chat", "Record", "Closed Caption" (with a "CC" icon), and a red "End Meeting" button.

Speaker View Gallery View

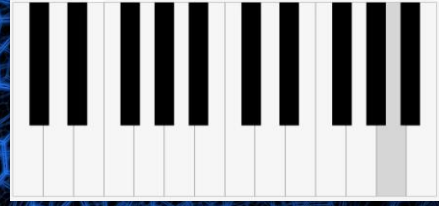
Hand icon

Microphone icons (all muted)

Camera icon (disabled)

JAMES

Invite Manage Participants² Polls Share Chat Record Closed Caption End Meeting



TIMELINE AND PROJECT

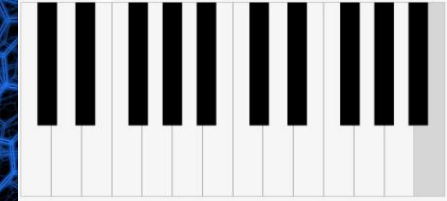
WHAT WE'VE DONE:

- **Touch sensor keys and modulator circuits**
- **Piezo circuits & peak detectors**
- **Final PCB order**
- **Sending MIDI signals from key presses & buttons**
- **Octave and hold features**



WHATS LEFT:

- **Working out LED wiring**
- **Finalizing enclosure design**
- **Modulator tuning**
- **Hierarchy of priority for interrupts/polling**
- **Arpeggiator, tempo indicator, and modes**



BUDGET

Parts before semester	Subtotal	\$104.67
Order #1	Subtotal	\$78.92
Order #2	Subtotal	\$26.20
Order #3	Subtotal	\$45.07
Order #4	Subtotal	\$1.10
Order #5	Subtotal	\$5.11
Order #6	Subtotal	\$55.86
Grand Total		\$316.93



WHATS LEFT TO ORDER?
Resistors
Capacitors

CONCLUSION



QUESTIONS?



REFERENCES

- ◇ [Capacitive touch module TTP-223](#)
- ◇ [AT42QT1010 Data Sheet](#)
- ◇ [Electrical Engineering Technology - Marine & Industrial, Diploma | Camosun College](#)
- ◇ [IQS7211AEV01-S.jpg \(2093×2093\)](#)
- ◇ [Diagonal Touchscreen - Charlieplexing - Wikipedia](#)
- ◇ [Adafruit Learning System](#)