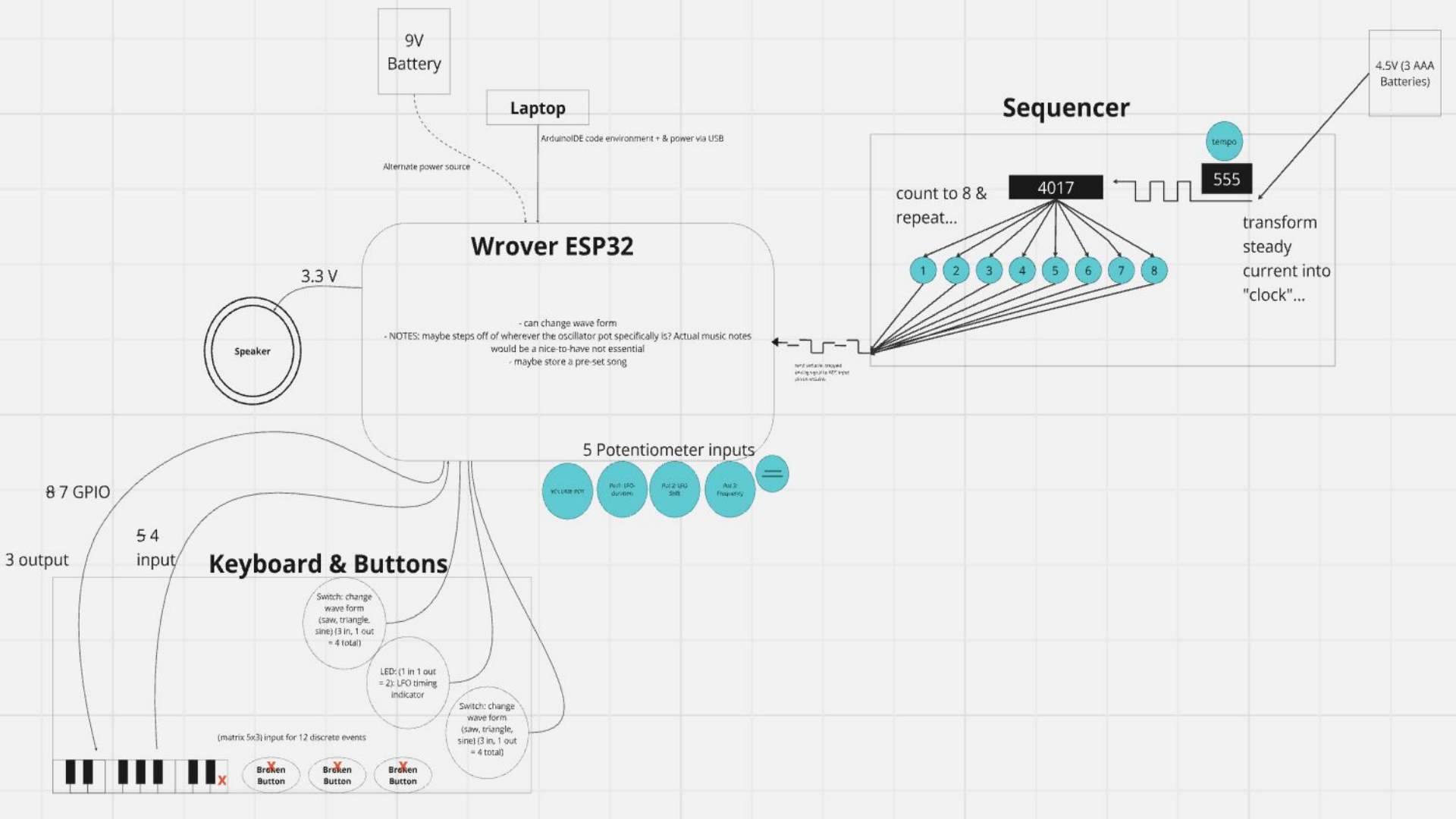
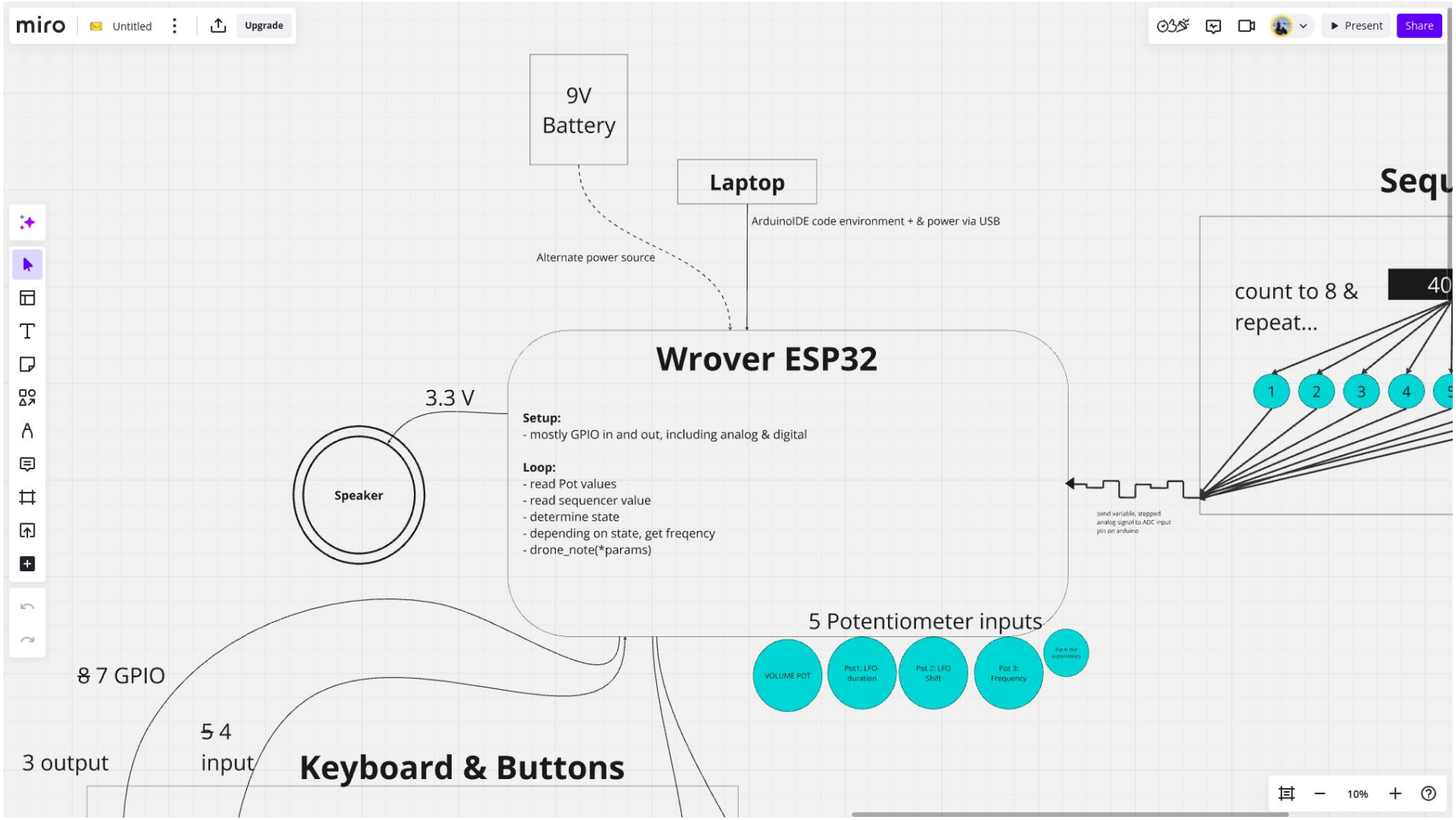
Digital Wrover-ESP32 Synthesizer with Analog 555 & 4017 Sequencer

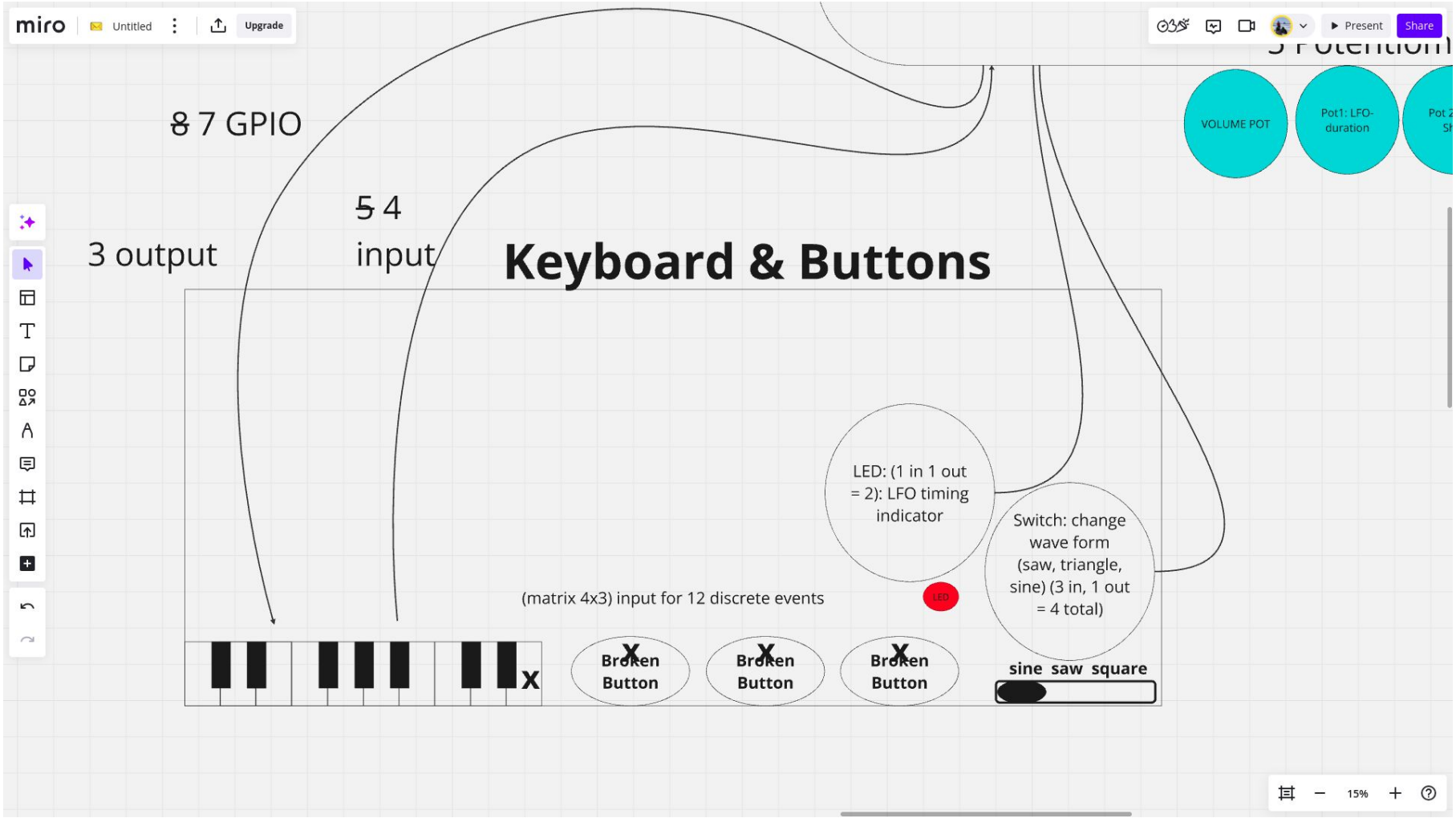
12/13/24

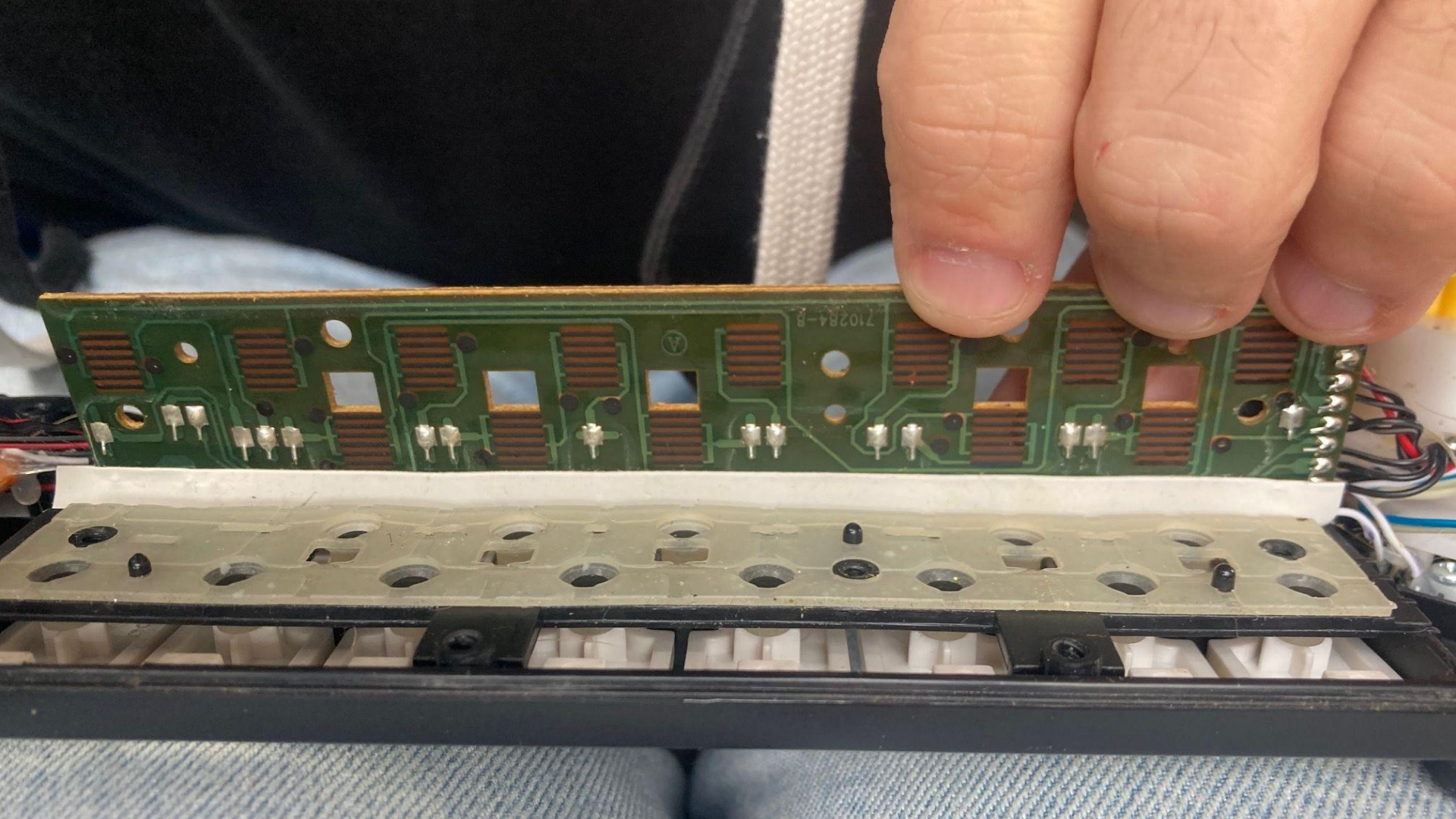
Quick Stats

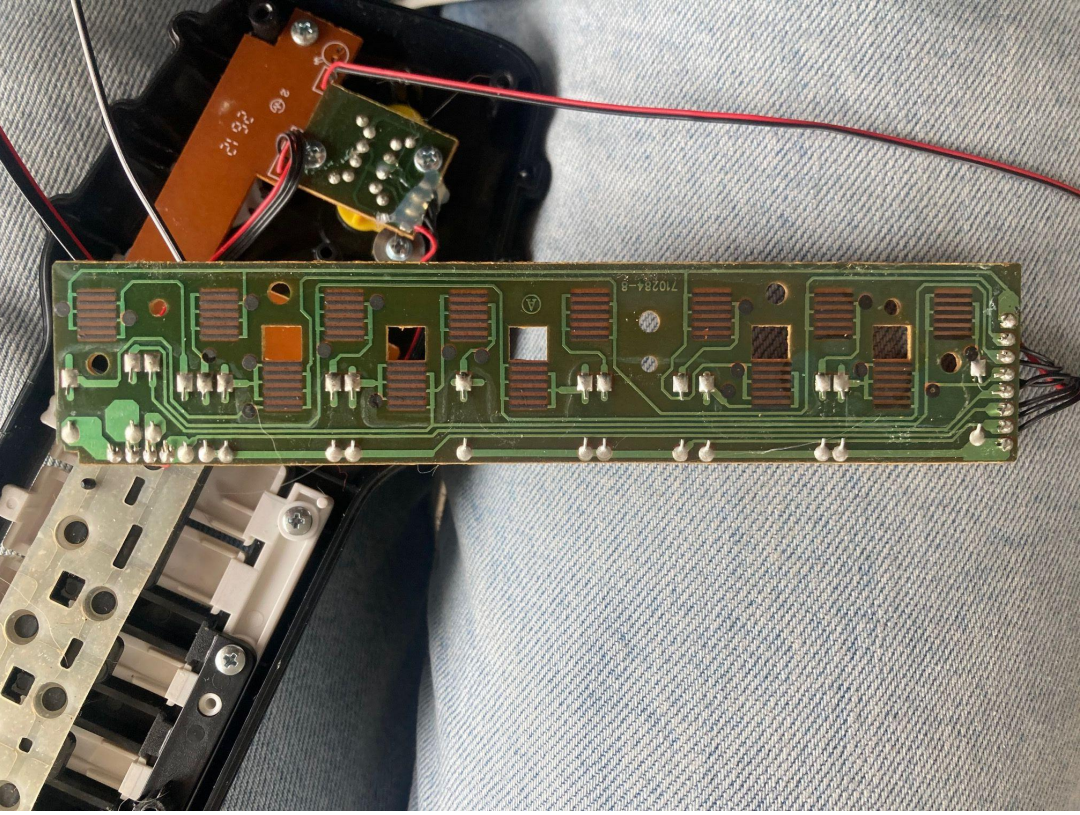
- 14 Potentiometers
- 1 ESP32-Wrover Microcontroller (programmed with ArduinoIDE software)
- 2 Chips (555 timer & 4017 decimal counter)
- 2 indicator LEDs
- Frequency Range 12 to 6,000 Hz
- 4 broken buttons
- 3 wave types (sine, saw, square)
- 2 power sources (4.5 volt battery & microcontroller)
- 13 Notes
- 3 Modes (Sequencer, Drone, Keyboard)


9V Battery
Laptop
ArduinoIDE code environment + & power via USB
Alternate power source
Wrover ESP32
3.3 V
Speaker
- can change wave form
- NOTES: maybe steps off of wherever the oscillator pot specifically is? Actual music notes would be a nice-to-have not essential
- maybe store a pre-set song
Sequencer
4.5V (3 AAA Batteries)
tempo
555
4017
count to 8 & repeat...
transform steady current into "clock"...
1
2
3
4
5
6
7
8
5 Potentiometer inputs
8 7 GPIO
5 4
3 output
input
Keyboard & Buttons
Switch: change wave form (saw, triangle, sine) (3 in, 1 out = 4 total)
LED: (1 in 1 out = 2): LFO timing indicator
Switch: change wave form (saw, triangle, sine) (3 in, 1 out = 4 total)
(matrix 5x3) input for 12 discrete events
Broken Button
Broken Button
Broken Button


9V Battery
Laptop
ArduinoIDE code environment + & power via USB
Alternate power source
Wrover ESP32
Setup:
- mostly GPIO in and out, including analog & digital
Loop:
- read Pot values
- read sequencer value
- determine state
- depending on state, get freqency
- drone_note(*params)
3.3 V
Speaker
count to 8 &
repeat...
40
1
2
3
4
send variable, stepped analog signal to ADC input pin on arduino
5 Potentiometer inputs
VOLUME POT
Pot1: LFO duration
Pot 2: LFO Shift
Pot 3: Frequency
8 7 GPIO
5 4
3 output
input
Keyboard & Buttons
Present
Share
Upgrade
Untitled
10%


miro
Untitled
Upgrade
Present
Share
~~8~~ 7 GPIO
~~5~~ 4
input
3 output
Keyboard & Buttons
VOLUME POT
Pot1: LFO-duration
LED: (1 in 1 out = 2): LFO timing indicator
LED
Switch: change wave form (saw, triangle, sine) (3 in, 1 out = 4 total)
(matrix 4x3) input for 12 discrete events
Broken Button
Broken Button
Broken Button
sine saw square
15%

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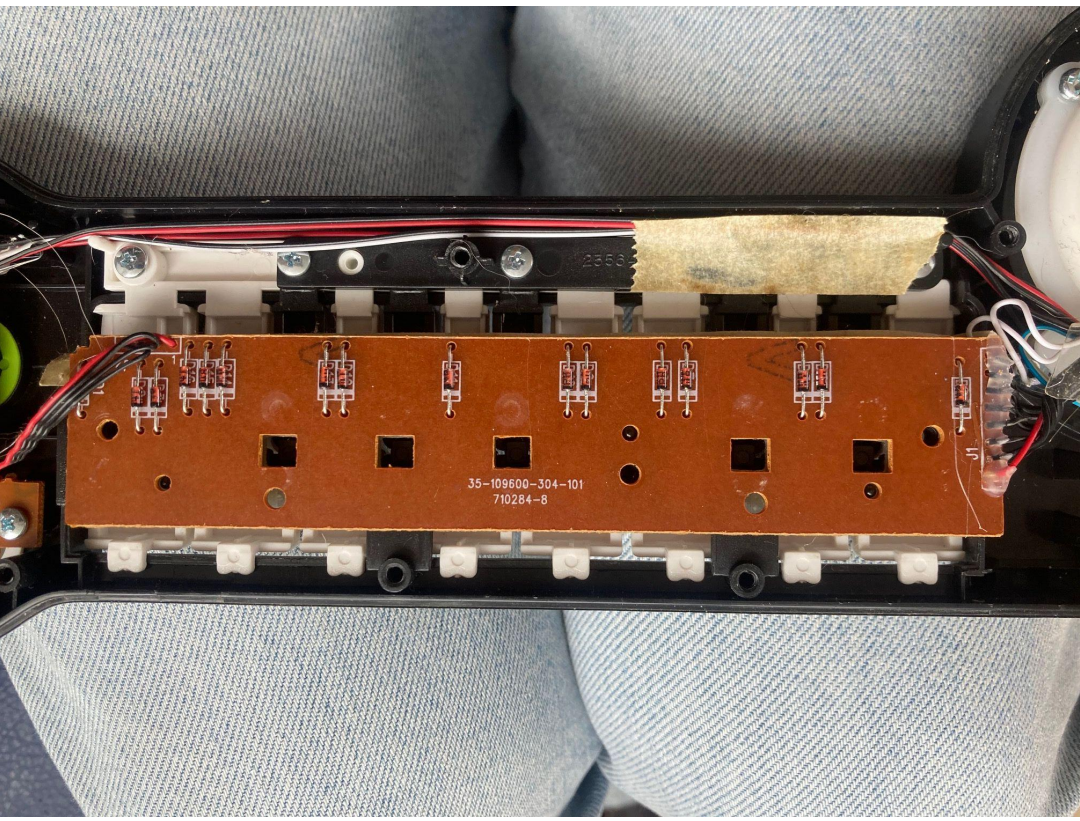
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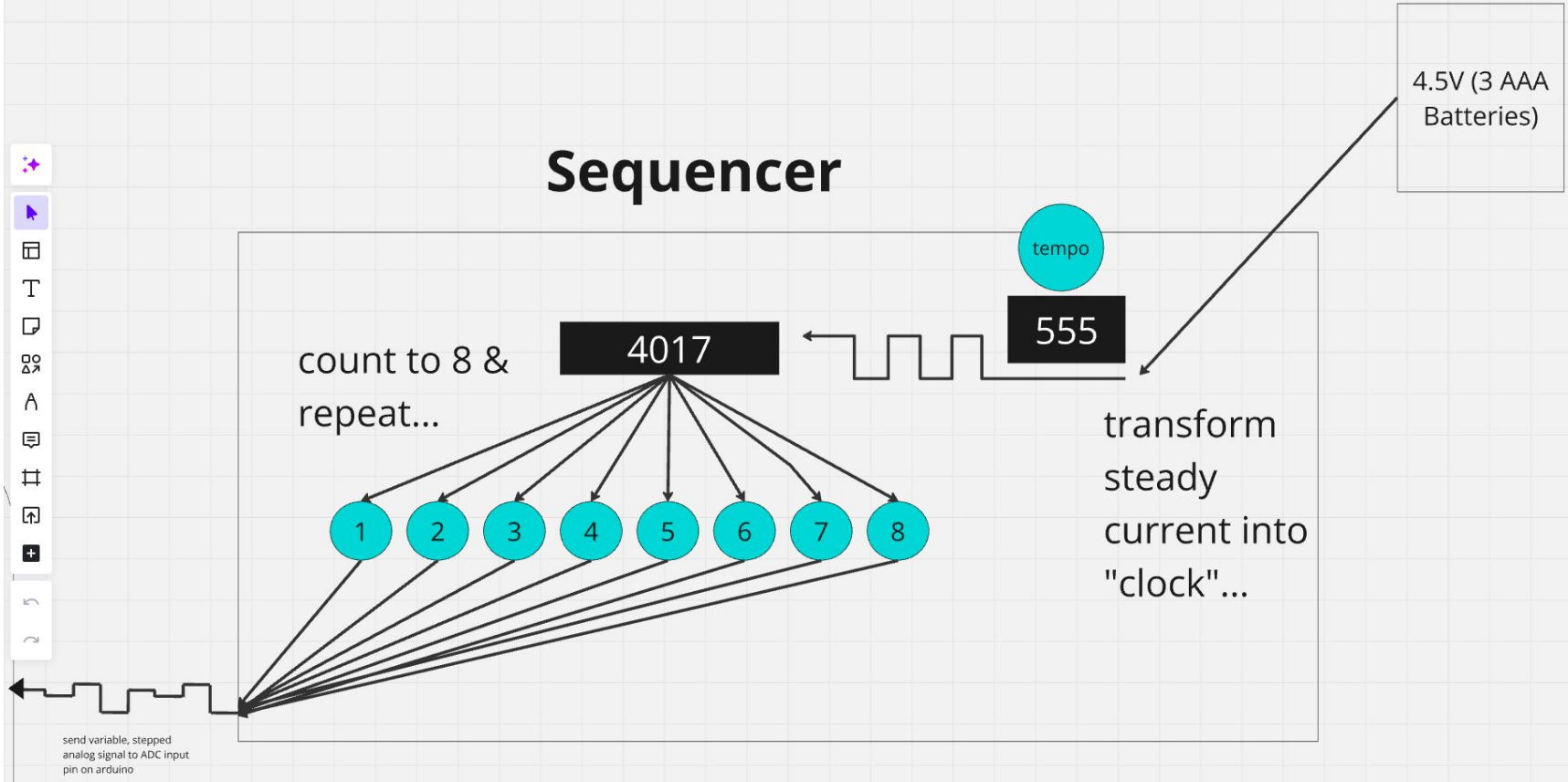
J1

Sequencer



Code

- arduinoIDE, .ino files, Setup() & Loop()

- started simple & object-oriented, "upgraded" to threading

- Three modes: Keyboard (O.O., which I can show you), Drone & Sequencer (threading, separate codebase (for now))

Demo!

Drone Mode:

https://www.youtube.com/watch?v=3Eg-PfTNHv8

Challenges

- keyboard (easy to get almost working, remained buggy)
- power supply
- subtle timing stuff (print statements causing weird behavior, etc)
- analog is hard & slippery to define
- exponential ranges of frequency -> linear potentiometer values
- debugging was hard on my ears

Conclusions and Future Work

- circuit bending

- working keyboard (midi potentially)

- more modules for existing synths (building off: https://www.youtube.com/watch?v=H5DJ5-TVORI)