Color Organ

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Week of 5/14/18 to 5/18/18

Objective: The objective of the lab is to understand how to build and then make a enclosed light organ.

Materials:

- Switching Diode
- 2 red LEDs
- 2 yellow LEDs
- 2 green LEDs
- 3 100 Ω resistor
- 180 Ω resistor
- 270 Ω resistor
- 2 1K Ω resistor
- 4 2.2K Ω resistor
- 2 10K Ω resistor
- 0.047 µFd capacitor
- 0.01 µFd capacitor
- 0.47 µFd capacitor
- 1 µFd capacitor
- 10 µFd capacitor
- Audio video
- 2N2222A NPN Transistor
- 3 2N2907 PNP Transistors

Procedure:

To begin a Multisim of the was made in figure 1.

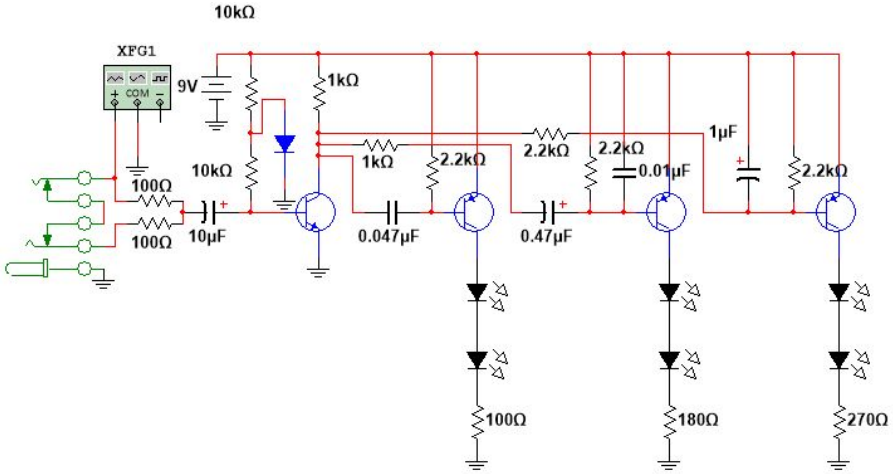
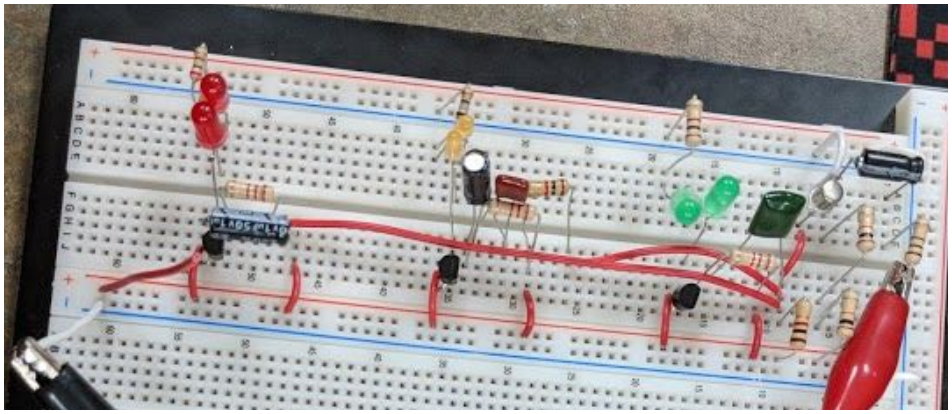


Figure 1

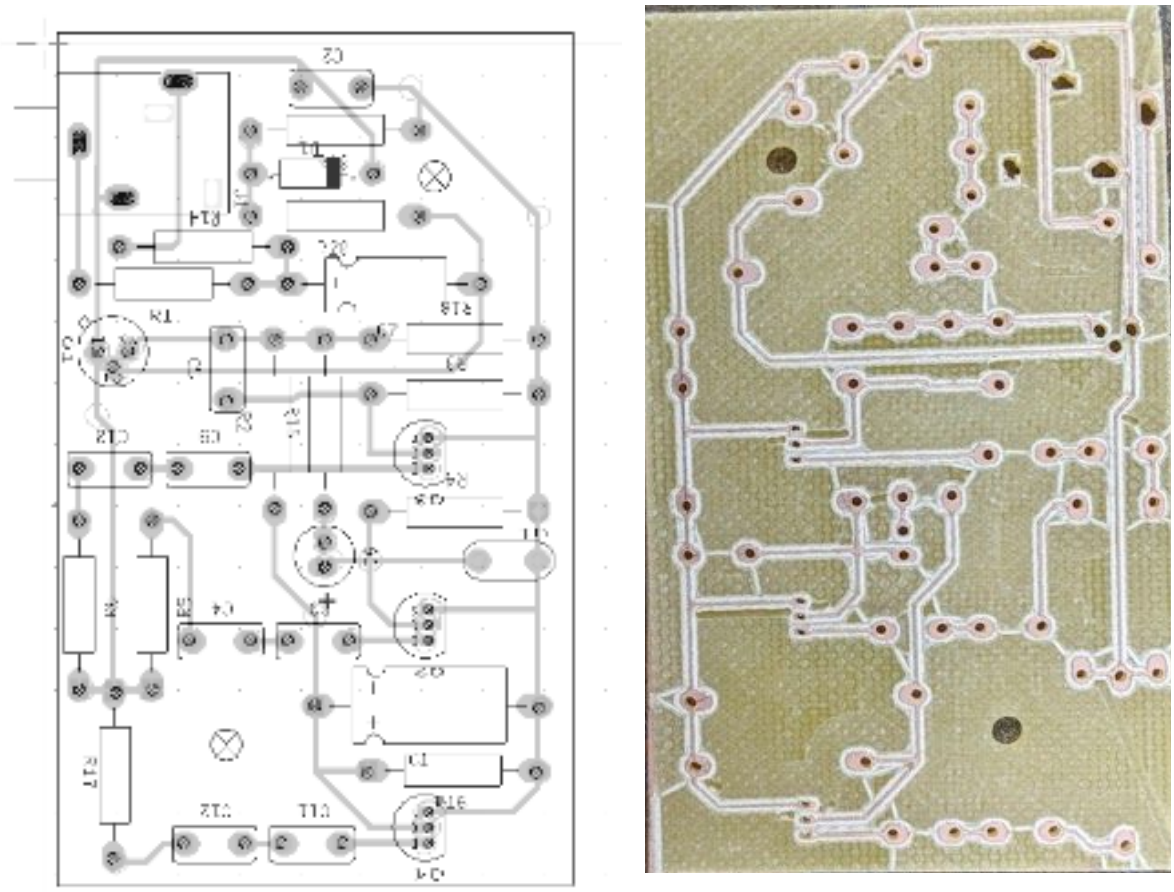
Then a protoboard version of the organ was constructed and a table that shows what each frequency cutoff is as shown in figure 2.

Figure 2



LED (Figure 2)	On when past (Real)	Off when past (Real)	On when past (Sim)	Off when past (Sim)
Green	850 Hz	2000 Hz	900 Hz	2100 Hz
Yellow	30 Hz	1847 Hz	20 Hz	1900 Hz
Red	1.5 Hz	Z500 Hz	10 Hz	500 Hz

Figure 3



After designing a schematic a copper board was made as shown in figure 3 above which connects all of the components together.

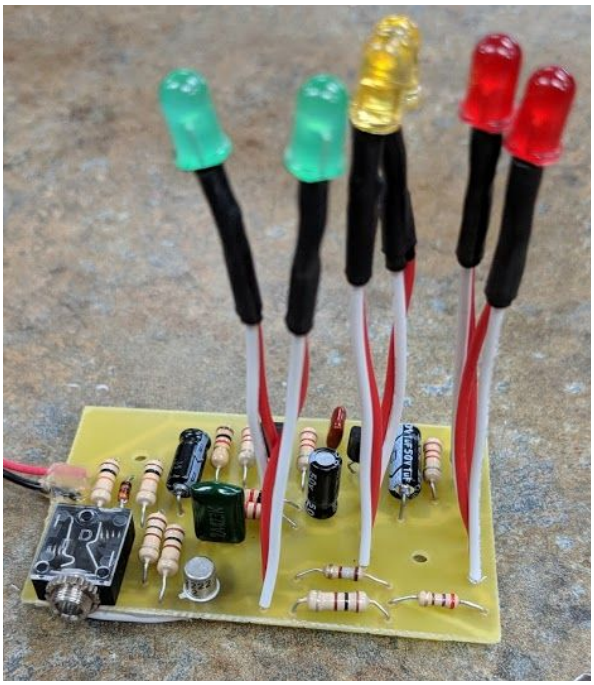
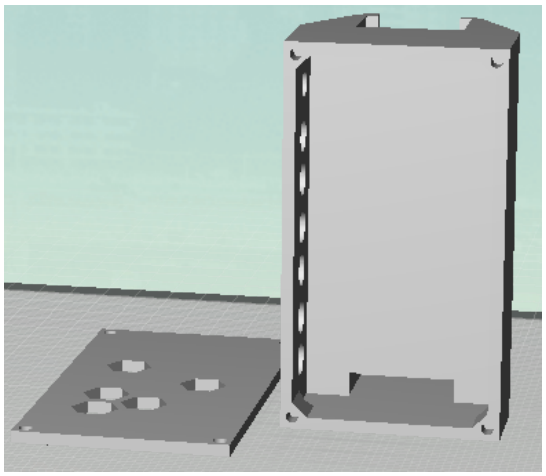


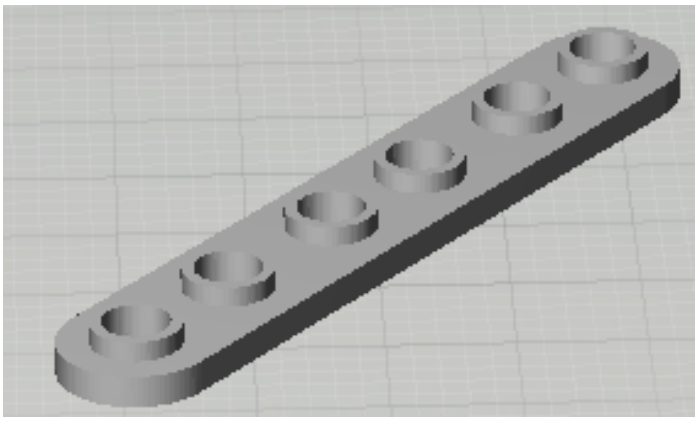
Figure 4

LED (PCB)	On when past	Off when past
Green	150 Hz	350 KHz
Yellow	6 Hz	2.5 KHz
Red	1.5 Hz	60 Hz

Once the ultiboard was printed the components were put into the board and the frequencies that each light turned on and off was measured as shown in figure 4.

Figure 5





Then a 3D printed box was created with a lid and a light holder as shown in figure 5 and the PCB board was placed in for the finished product in figure 6.

Figure 6

Discussion:

The lab was straightforward to complete and the measurements are most likely off because of rounding and tolerance in each filter. When both bread-boarding and building the PCB of the circuit we had a few problems. The main problem with the breadboard at first was that all of the transistor were not placed correctly in the circuit despite us consulting the datasheets and schematic of the transistors. After these parts were placed incorrectly they would need to be both placed correctly and swapped with new parts as the old parts had no longer worked correctly. When building the PCB we again had some problems, the headphone jack was improperly wired into the circuit. The ground of the jack was connected to a positive terminal, and a positive terminal was connected to ground. As well these new transistor had also broken in side the circuit so they had needed to be replaced, but the traces of the circuit were far too small and had broken, torn, or burnt off of the PCB. So when placing new transistors inside of the circuit, jumper wires were required in some places in order to properly add these new parts to the PCB. When the 3d box was printed the holes for the LEDs were far too large due to holes

becoming 0.05in smaller than what they were designed. As well when printing a part to compensate for the larger holes, an error was mistaken as that the part has finished, causing a unfinished part to be used to fix this problem that I had created for myself.

Conclusion:

A light organ uses a low pass, high pass, and bandpass filter to cause the different LEDs to light up at different frequencies. The organ works by receiving frequencies from the audio jack which are filtered through the 3 filters causing certain lights to turn on at certain frequencies. The 2N2222A transistor outputs a square-like wave to the collector of the transistor, and the drops of this wave trigger the various 2N2907 transistor at the frequencies that the passes require to fire. These dips from the 2N2222A transistor, when they arrive at the base of the 2N2907 the transistor produces a spike of voltage to the collector that the LEDs use to turn on.