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4   Sensing with Noise (OpAmps)

4. 1.
- 1 shows the circuit diagram for this question. I just used my 2.3.1 circuit with an added pulldown resistor at the phototransistor sensing terminal to increase the sensitivity of the circuit. I also increased the gain of the circuit by increasing the value of the resistance in the feedback loop of the OpAmp.
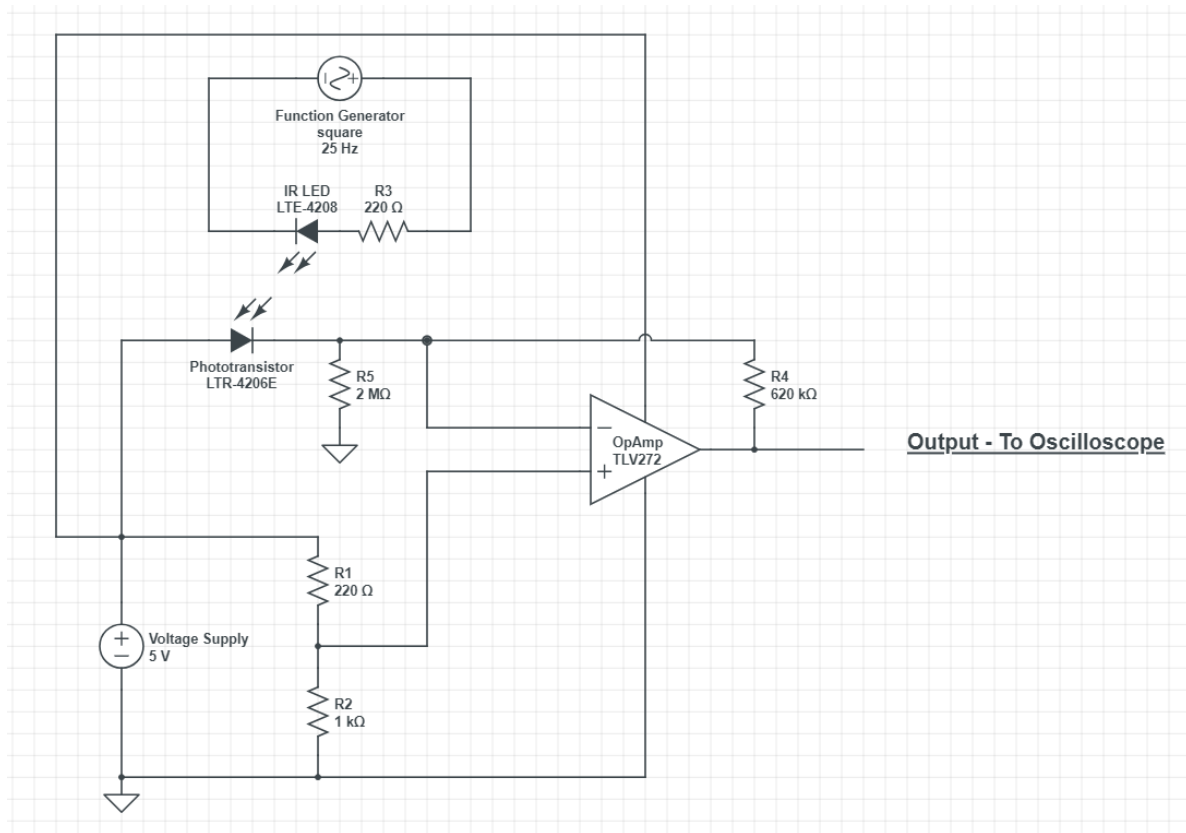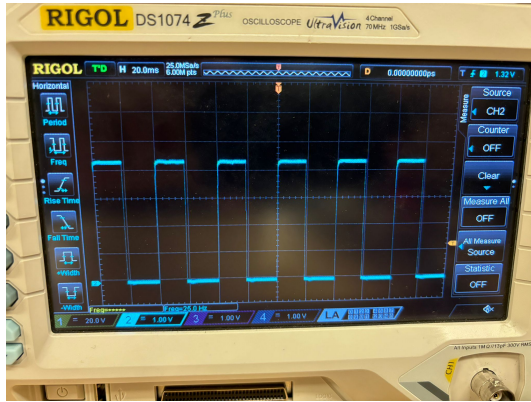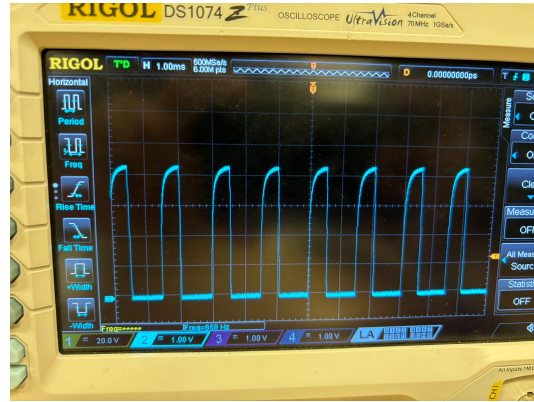

Figure 1: Circuit diagram for sensing frequency of 662 Hz from 1 m away

- We can see that the oscilloscope senses the 662 Hz (and also the 25 Hz) signal pretty accurately in 2.

2.
- 3 shows the circuit diagram for sensing the frequency from the LED and blinking the respective LEDs (red for 25 Hz, green for 662 Hz).

((a)) 25 Hz ((b)) 662 Hz

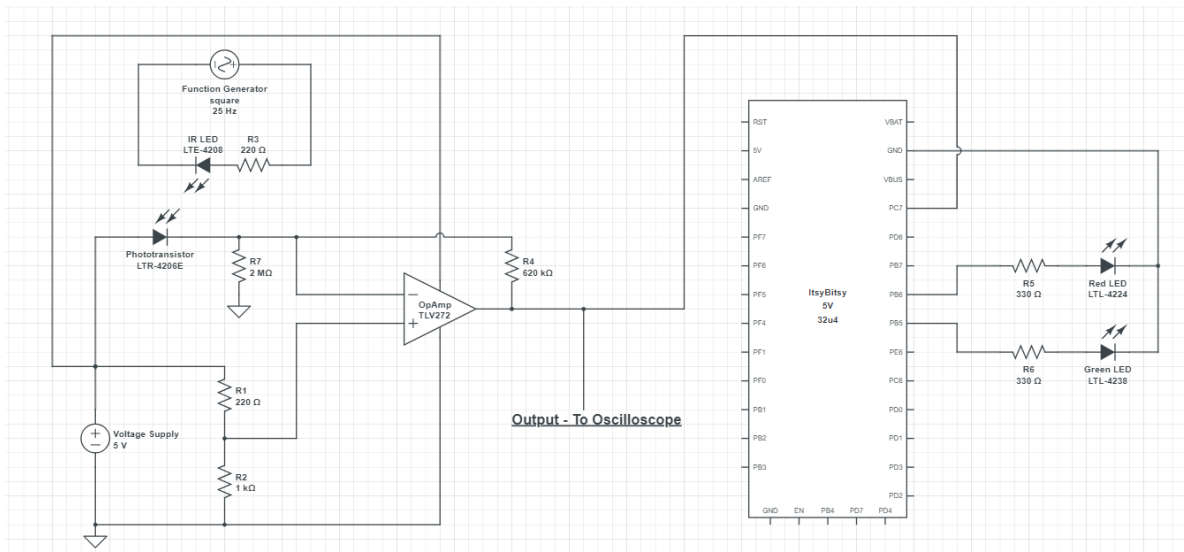Figure 2: Oscilloscope output images of the circuit for two frequencies

Figure 3: Circuit diagram for frequency detection of 25 Hz & 662 Hz

- The commented code is submitted separately on Gradescope (same as 2.3.2).
- Checked off by TA Binglong.

3. Extra Credit:

- The commented code is submitted separately on Gradescope, where logic for another blue LED is added.
- The circuit diagram with the added blue LED to detect 200 Hz can be seen in 4.

5   Retrospective

0. 1. Switches and debouncing and input capture - 6-7 hours
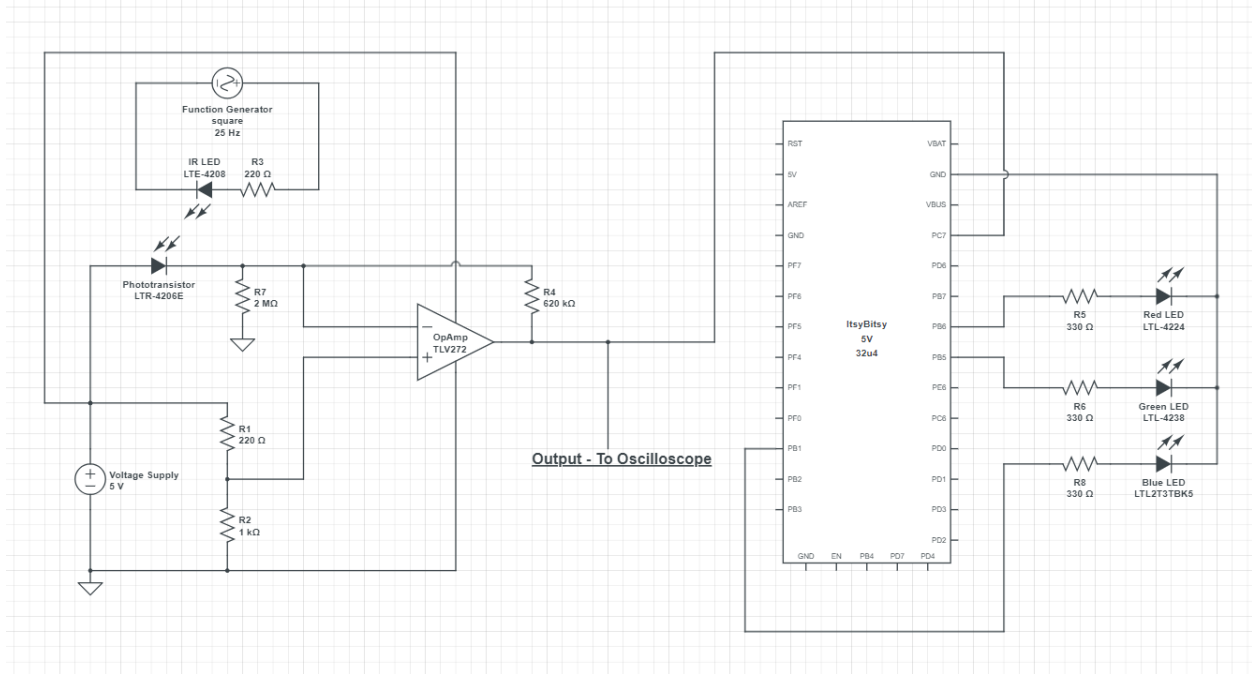
2. Phototransistors - 3-4 hours

Figure 4: Circuit diagram for sensing 200 Hz at 2 m distance

3. Frequency detection - 10-11 hours

4. Sensing with noise (OpAmps) - 15-16 hours

6   References

1. Latex template from the course CIS 5190 taught this fall.

2. MEAM 5100 Fall 2024 Lecture Slides.

3. Digikey for LED specifications and datasheets.

4. Stack Overflow for writing in C.

5. ItsyBitsy from CircuitLab

6. I performed some of the experiments in the lab with other people but have written my own report.