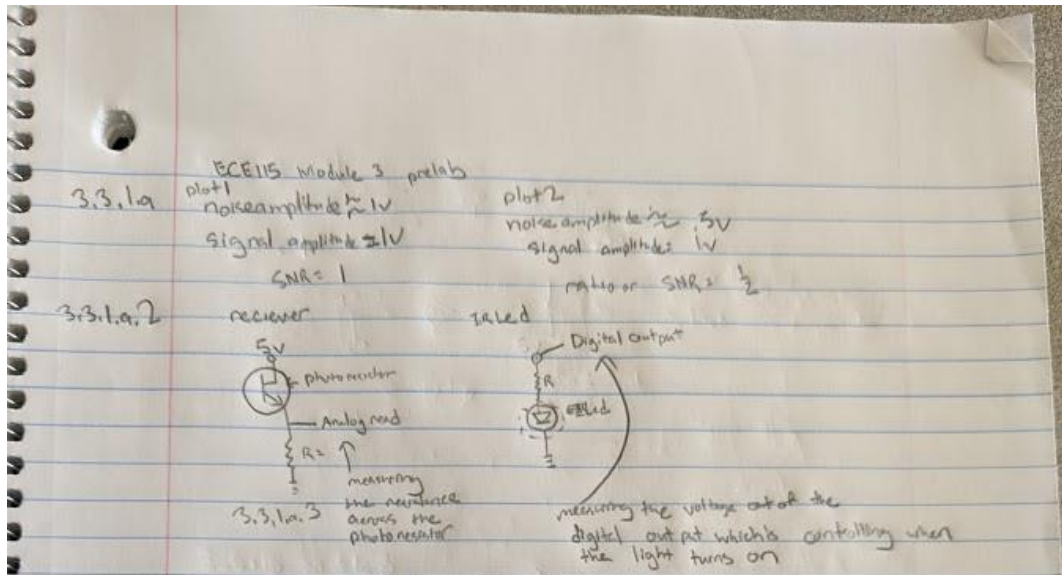Jonathan Oen

PID: A14547654
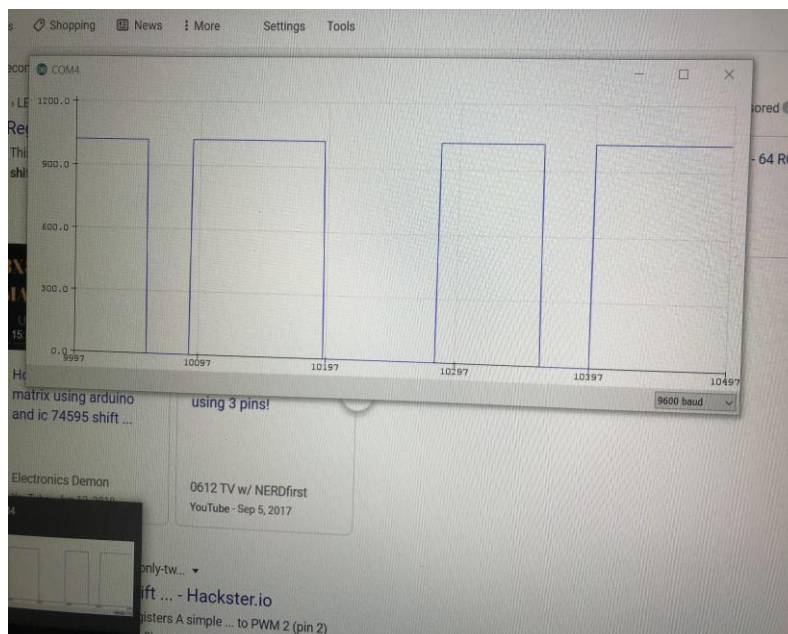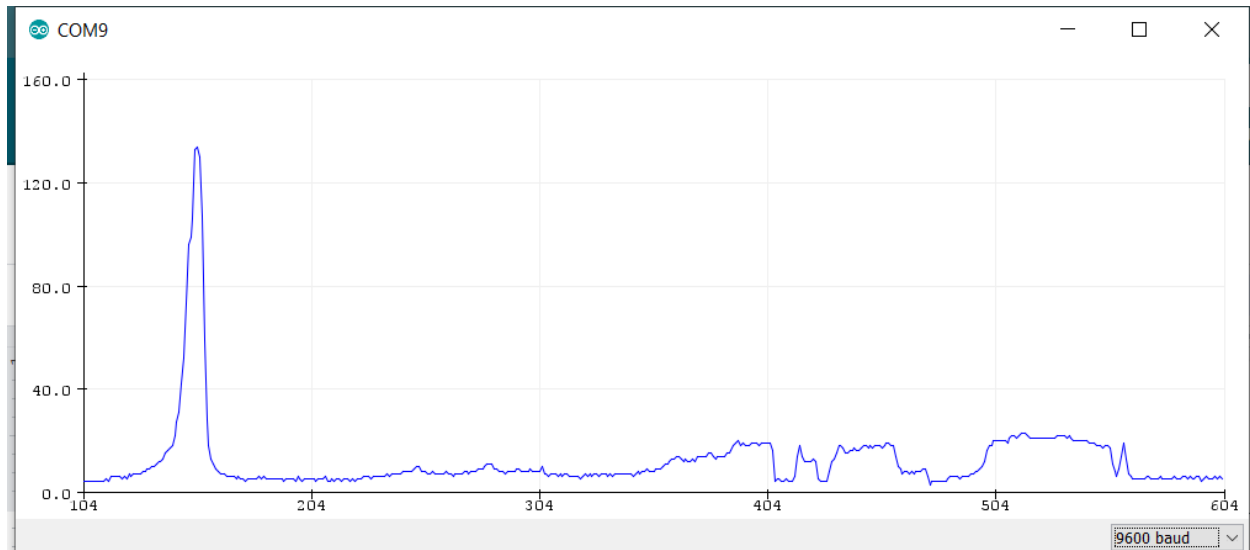
Module 3 Write Up

3.3.1.a

3.3.1.b.

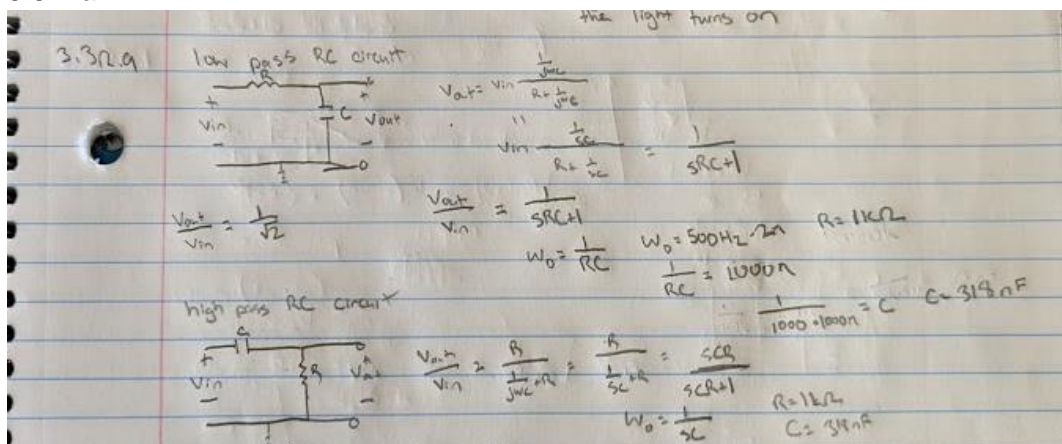Results of the IR sensor circuit

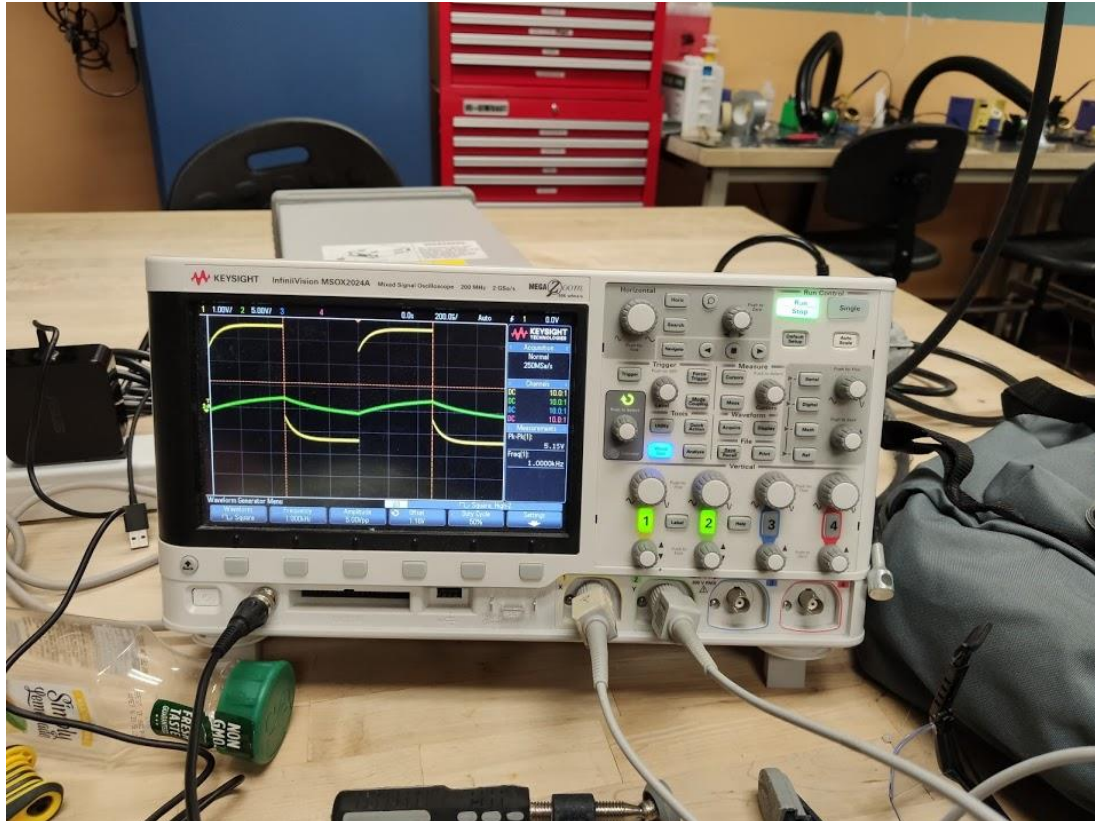IR sensor reading high or low

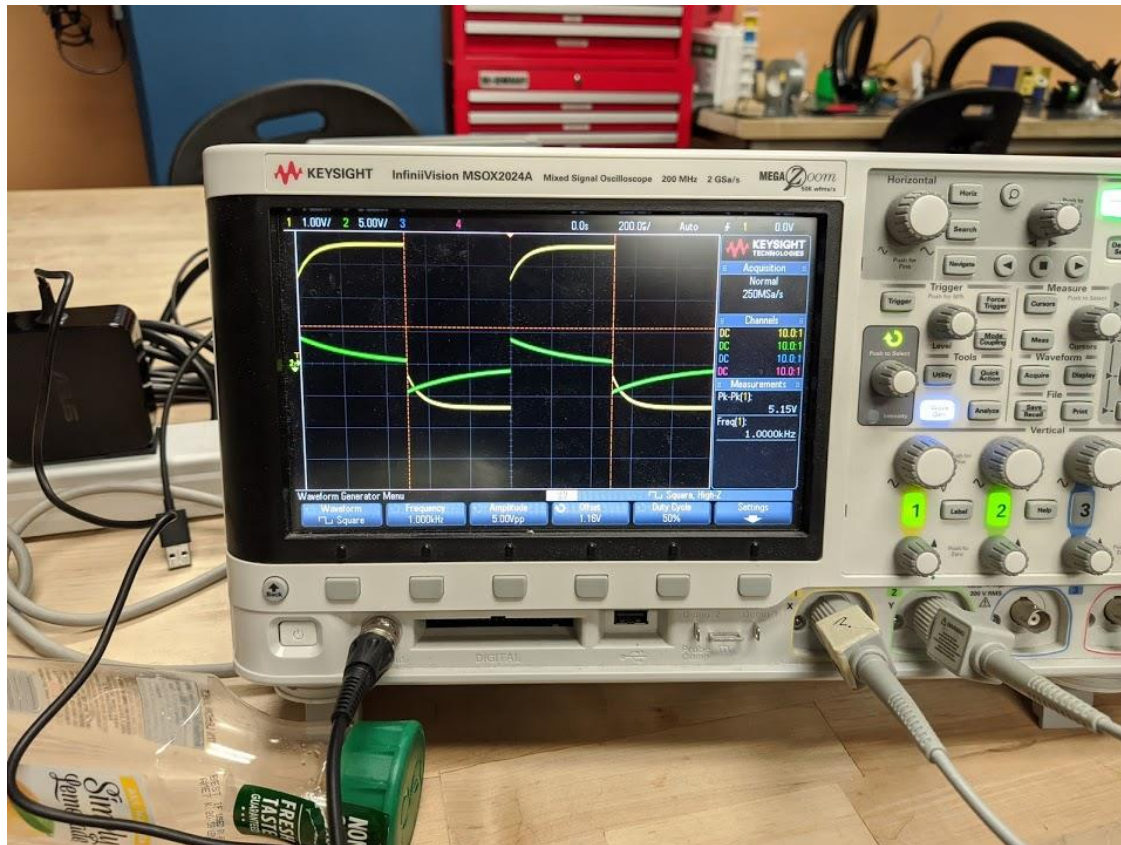Detects an object at about 8cm

3.3.2.a

Low-pass filter

We want to use a lowpass filter to filter out the high frequencies and preserve our DC offset.
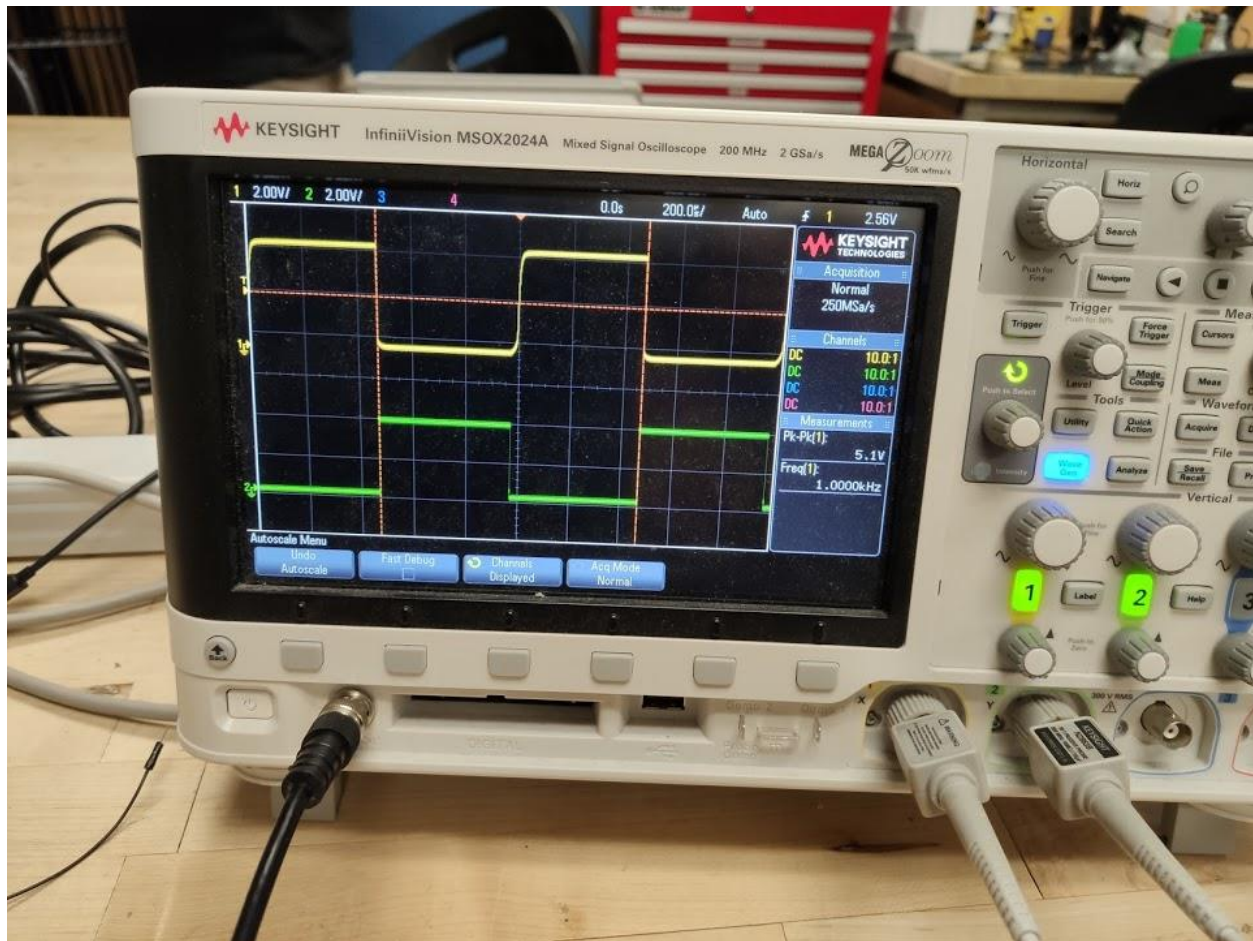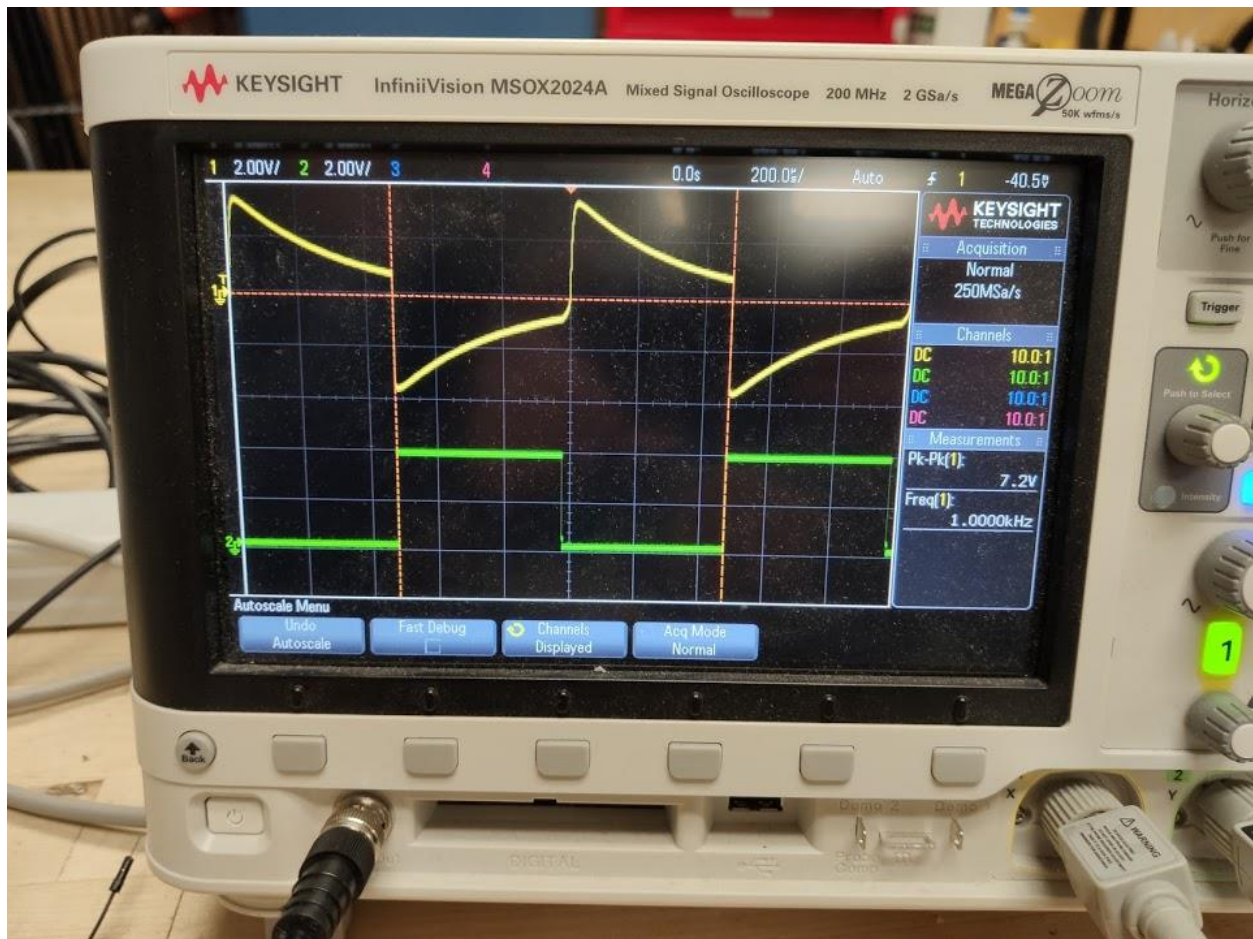
High pass filter

3.3.2.b
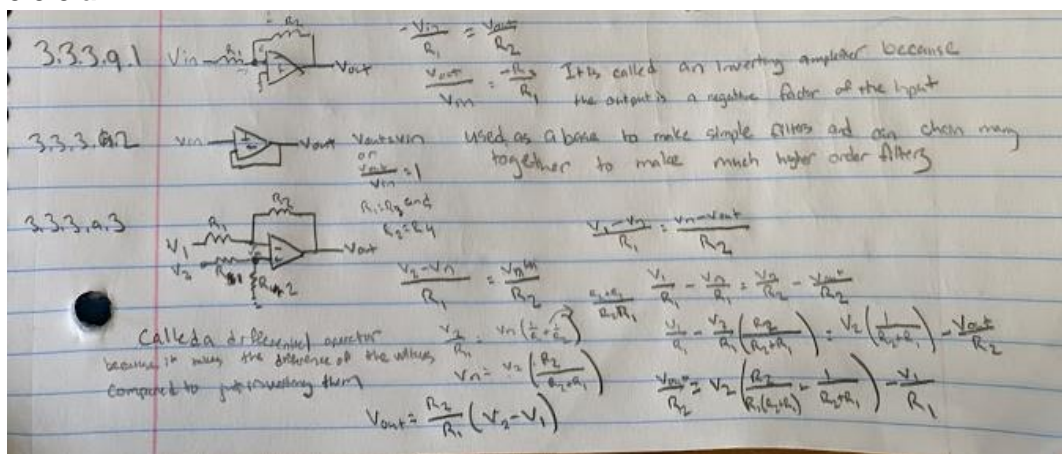
IR sensor unfiltered

5.1 V peak to peak

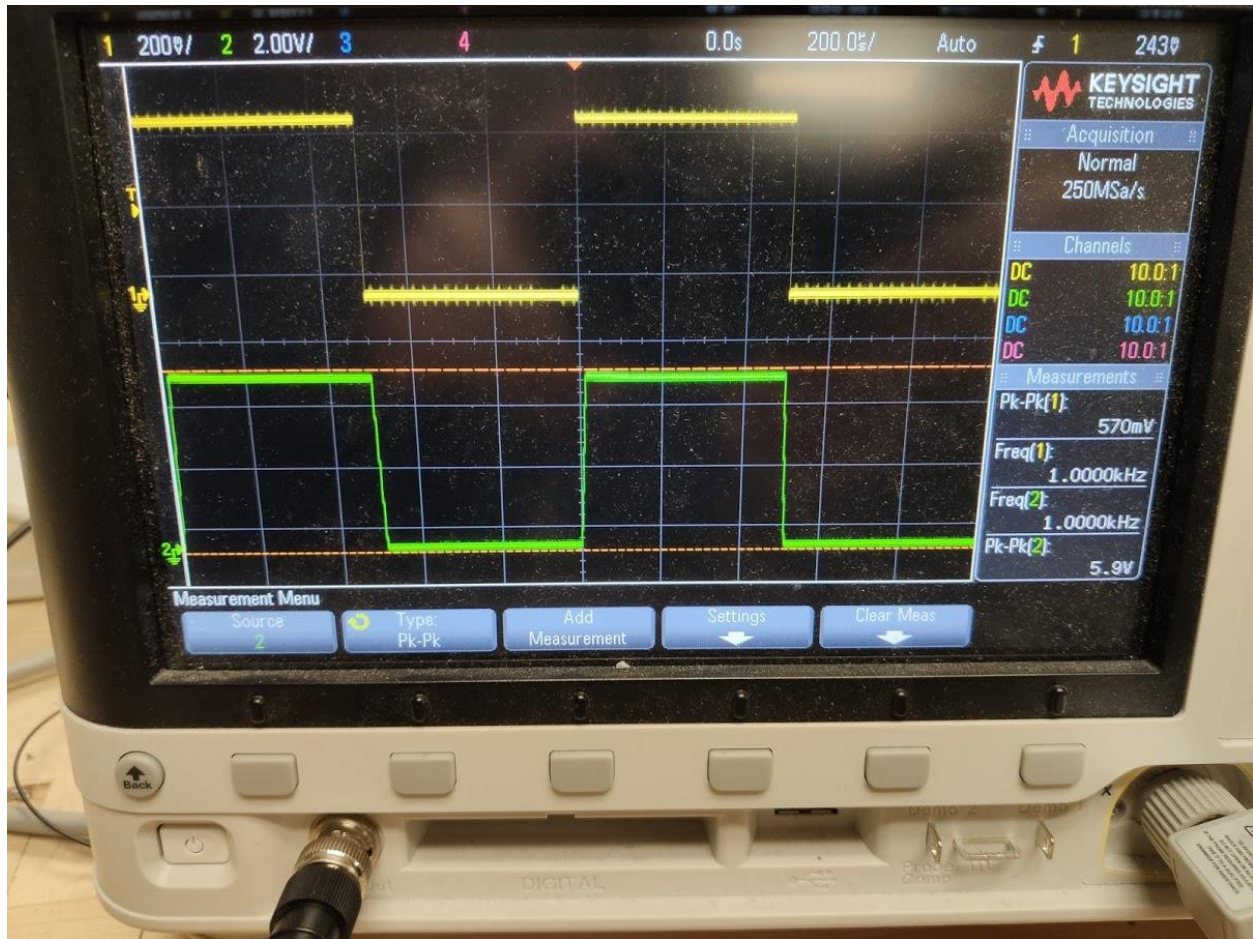IR sensor with a high-pass filter

7.2 V peak to peak

3.3.3.a

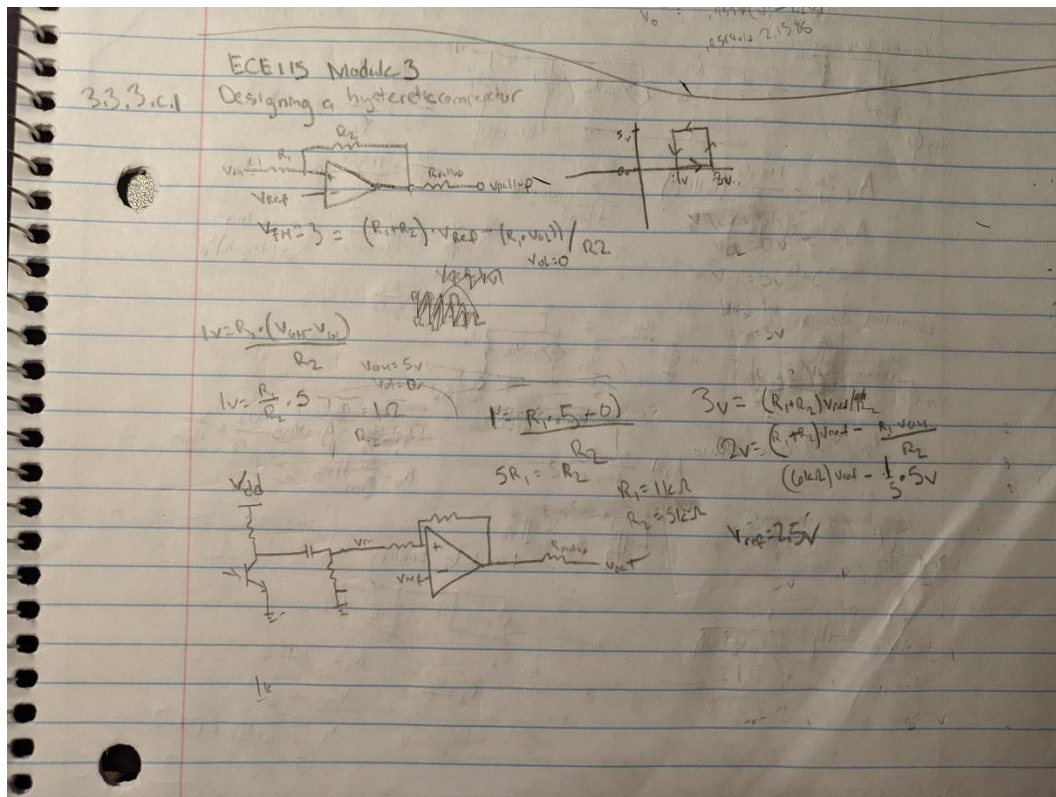**3.3.3.b**

Amplified voltage by 10x

The voltage gets clipped by the saturation which is 15V and can't go any higher due to that. Other than that, we successfully built a voltage follower that amplifies the signal 10x

3.3.3.c
Comparator design

ECE115 Module 3

3.3.3.C.1 Designing a hysteretic comparator

$V_{TH-3} = \left(R_1 + R_2\right) V_{ref} - \left(R_1 \cdot V_{ol}\right) / R_2$

$V_{ol} = 0$

$I_v = R_1 \cdot \left(V_{OH} - V_{ol}\right)$
$\qquad R_2$

$V_{OH} = 5V$

$I_v = \frac{R_1}{R_2} \cdot 5 = 1\Omega$

$5R_1 = 5R_2$

$R_1 = 1k\Omega$
$R_2 = 5k\Omega$

$V = R_1 \cdot (5 + 0)$
$\qquad R_2$

$3V = \frac{(R_1 + R_2) V_{ref} / 4^{th}}{}$

$2V = (R_1 + R_2) V_{ref} - \frac{R_1 V_{OH}}{R_2}$

$(6k\Omega) V_{ref} - \frac{1}{5} \cdot 5V$

$V_{ref} = 2.5V$

Comparator with Hysteresis XY plot
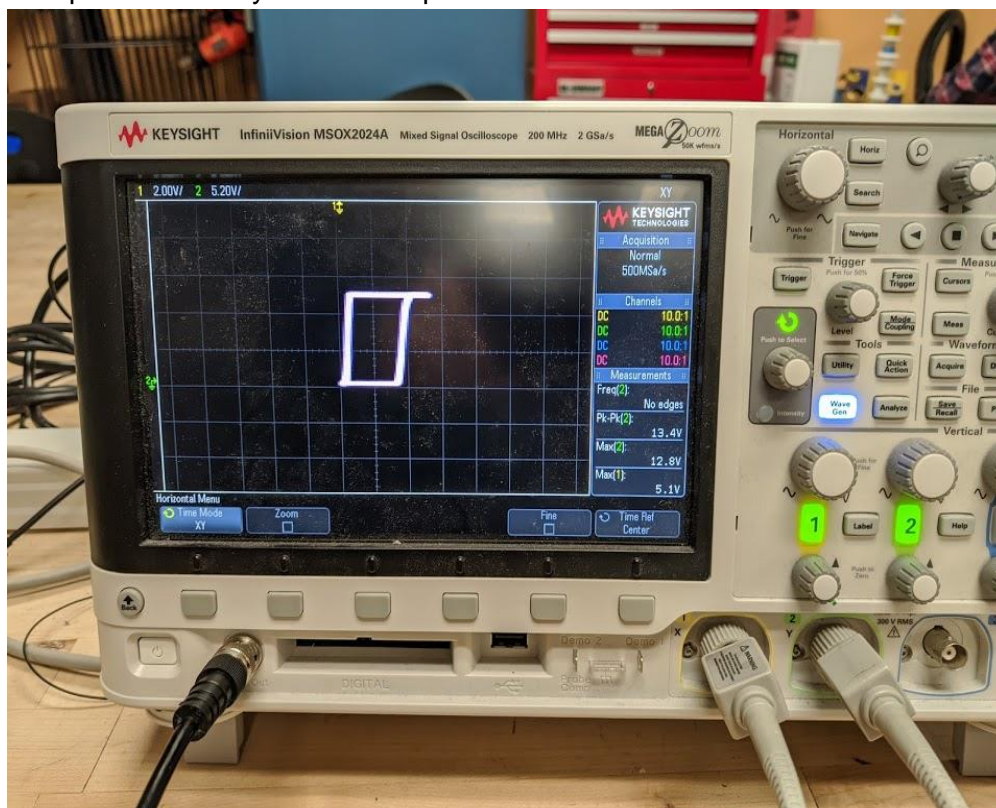
Implementation of Comparator to convert analog values from the sensor to digital ones (Comparator circled in blue)

3.3.4.a.1
Proximity Sensor System circuit diagram

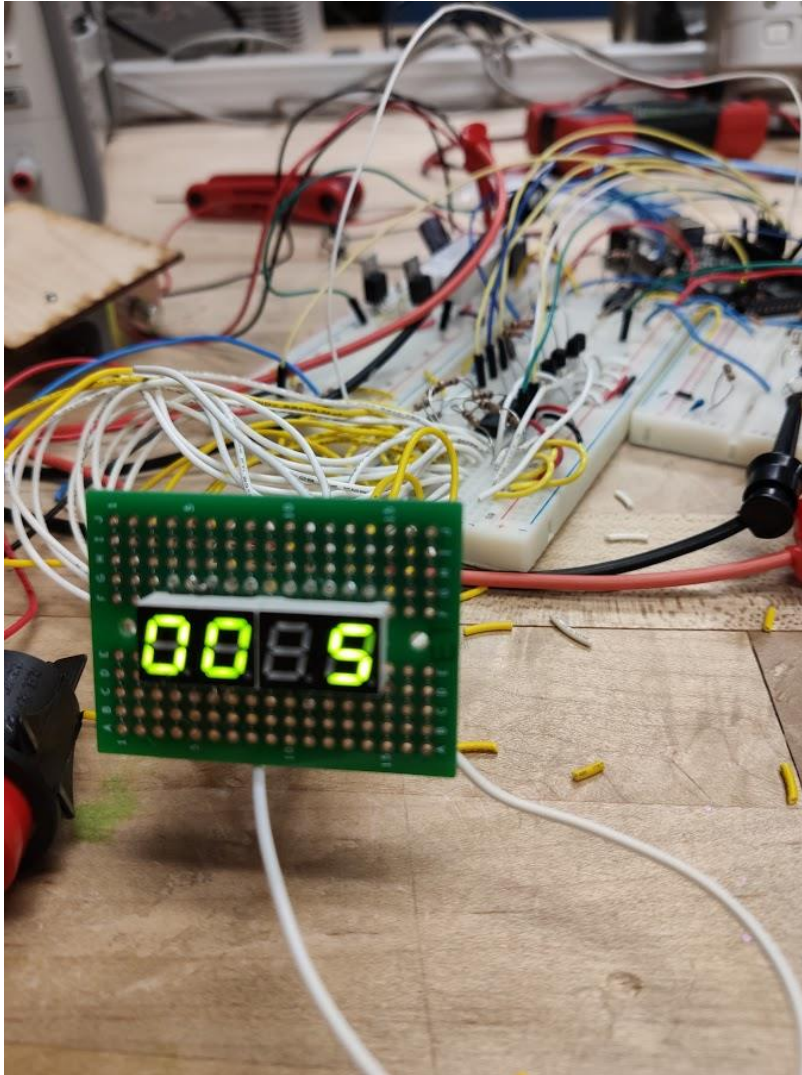3rd digit is off, because the camera shutter speed isn't fast enough

Code block diagram

3.3.5

Complete Circuit Diagram

Testing CAD

Whole system
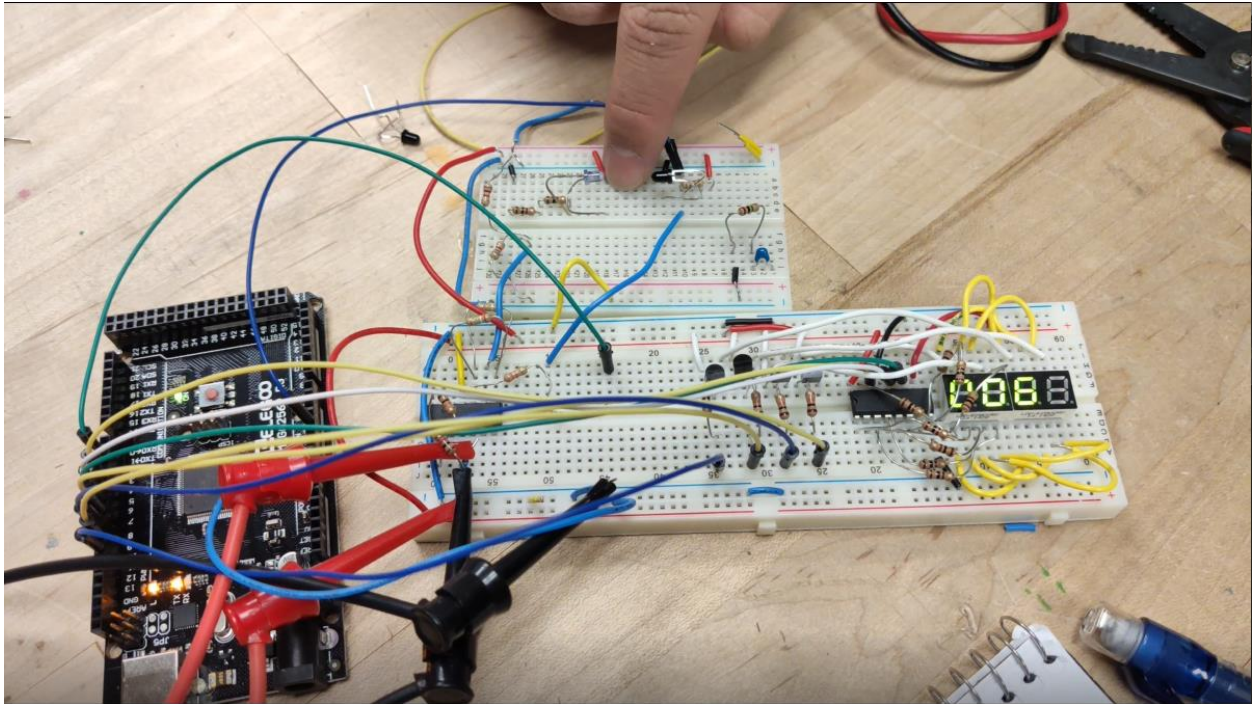
Design Specifications

1) Able to detect ball rolling past and counting on the 7 segment display
2) Phototransistor detecting the ball at x distance
3) Able to count up to 100

Specification Number	Specification Description	Test to perform	Relevant requirement	Specification [units]	Measured Values [units]
1	Detection of the ball rolling past the sensor and incrementing the display	Numbers counted	1,3	100 points	9999 points
2	Photosensor detecting the IR LED	Moving an object as far as possible to find out the range	2	10 cm	8 cm

Redesign notes

Currently, the wires coming out of the protoboard are a mess and have mis-matched length. This ended up messing with our original circuit and ultimately ruining our electronics on our system and causing our display not to work. Our current plan is to cut our wires such that they have matching lengths and to redo our circuit such that there are fewer wires sticking out of the breadboard. Other than that, our system worked to perfection, with the sensor and display working perfectly as planned before the mishap.