Venom-D Prototype

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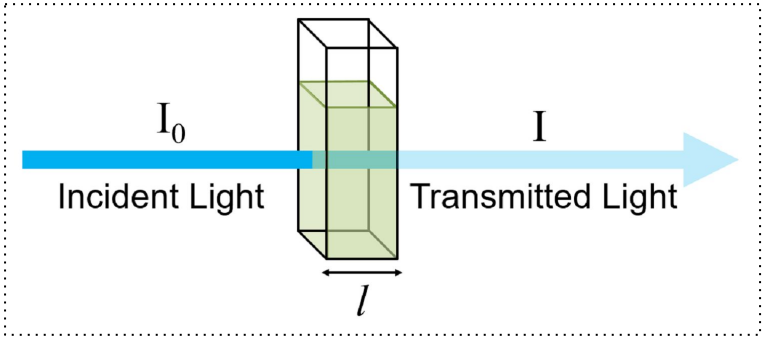
NeuRonICS Lab
Neurally - Inspired Reconfigurable Intelligent Circuits & Systems

Introduction

- The idea to detect various snake species venom in human blood to do a one-to-one mapping of venom and the snake species using Venom Detection Kit
- Currently, we are detecting a specific venom in gold nanoparticles sample using a low-cost handheld device.
- Keynote: Gold nanoparticles has the an absorbance peak at 520 nm wavelength and when added with a specific venom there will be a wavelength peak shift.

Beer-Lambert's Law

"The Beer-Lambert law states that the quantity of light absorbed by a substance dissolved in a fully transmitting solvent is directly proportional to the concentration of the substance and the path length of the light through the solution."



Transmittance:

$T = I / I_0$

% Transmittance: $\%T = 100\ T$

Absorbance:

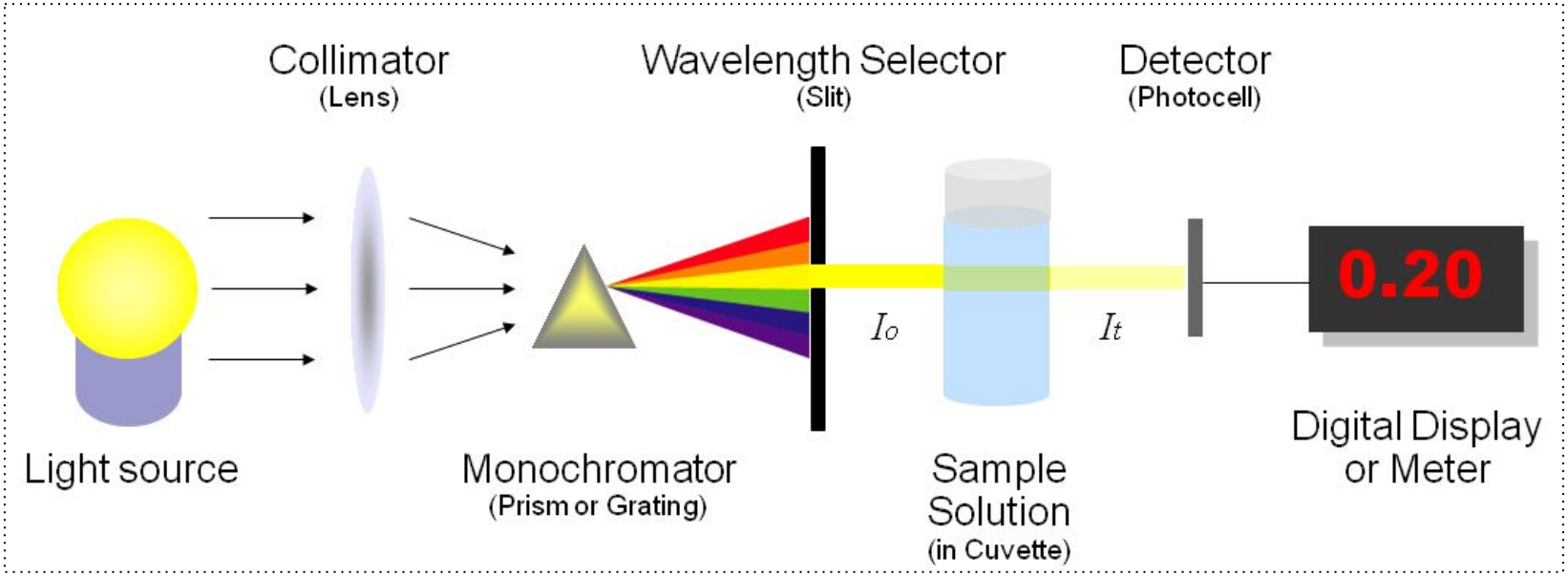
$A = \log10\ (I_0/I)$

$A = \log10\ (1/T) = -\log10\ (T)$

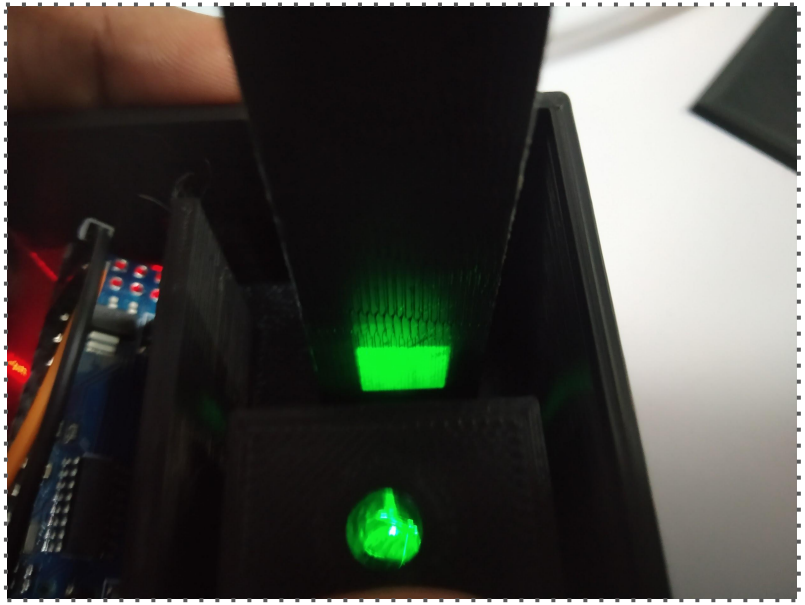
$A = \log10\ (100/\%T)$

$A = 2 - \log10\ (\%T)$

Conventional Spectrophotometer



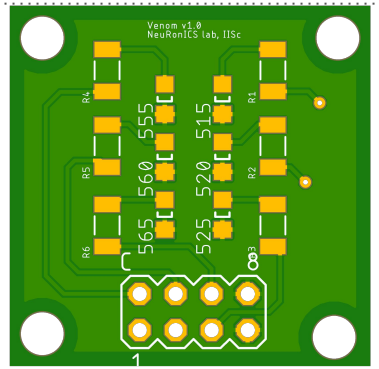
What's in the box?



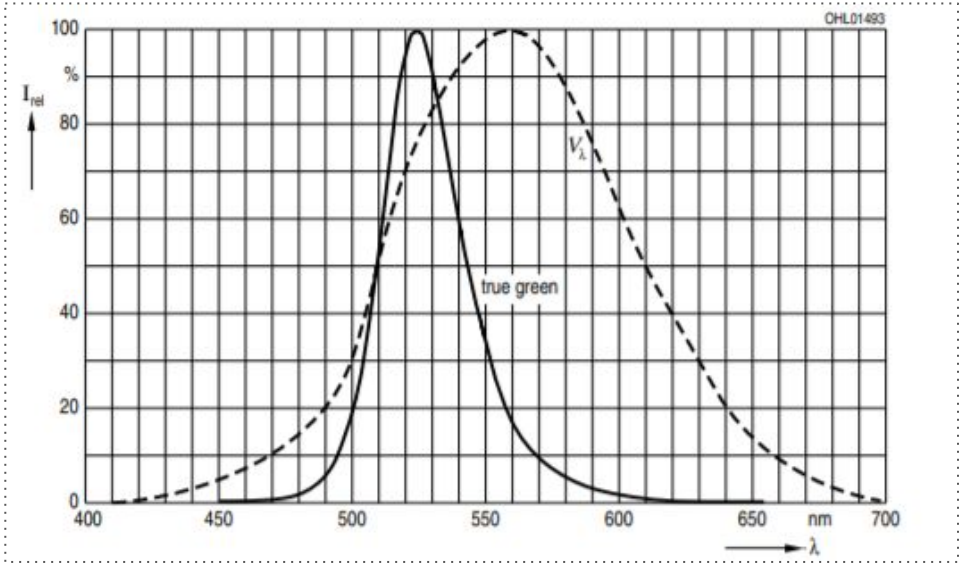
- SMD LED as transmitting sources.
- Photodetector array IC board
- Arduino Nano microcontroller.

Transmitter Board

- Using narrow-band, dominant wavelength LEDs as light sources for a specific wavelength absorbance.
- 6-point light sources.

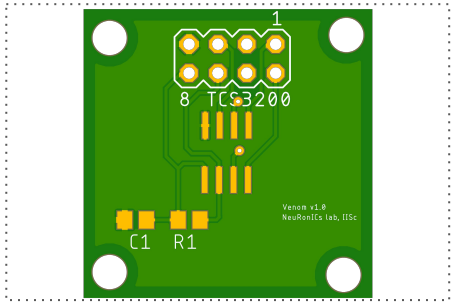


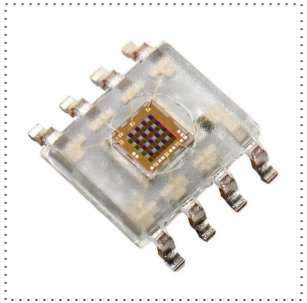
Spectral Response: Wavelength vs Luminous Intensity

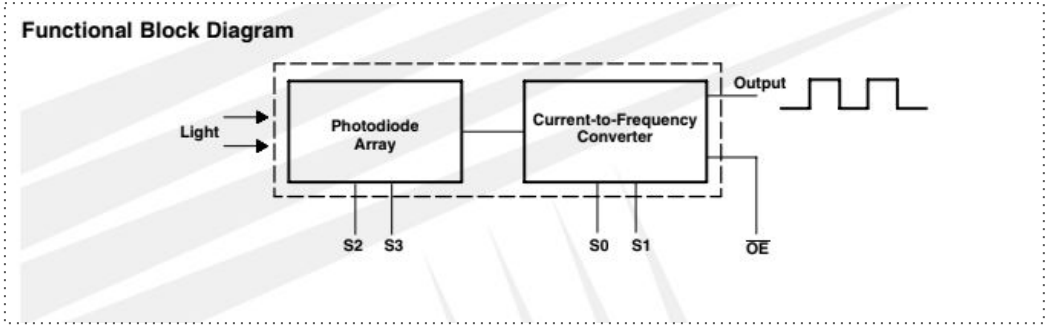


Receiver Board

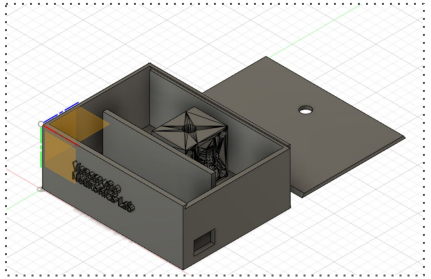
- TCS3200 - Light(irradiance) to frequency converter.
- 8 x 8 array of photodiodes.
  - 16 blue filters, 16 green filters, 16 red filters and 16 clear filters.
- The output is a square wave (50% duty cycle) with frequency directly proportional to luminous intensity (irradiance).







Cheat Sheet: 3D modeling and printing



Modeling

B: TinkerCad
A: Fusion 360

Export → .stl

Models dump: Thingiverse

Slicing

Import

B: Cura
A: Slic3r

Export → .gcode

SD Card → Network: Browse the IP

Printer Configuration

Material: PLA
Nozzle: 0.4mm

Print Setup

Layer Height: 0.2(REC)
Infill: 50%

Note: Need to use generate support option for some models; filament won't stick in air.

Printing: Calibrating the printer

B: Quick
A: Full

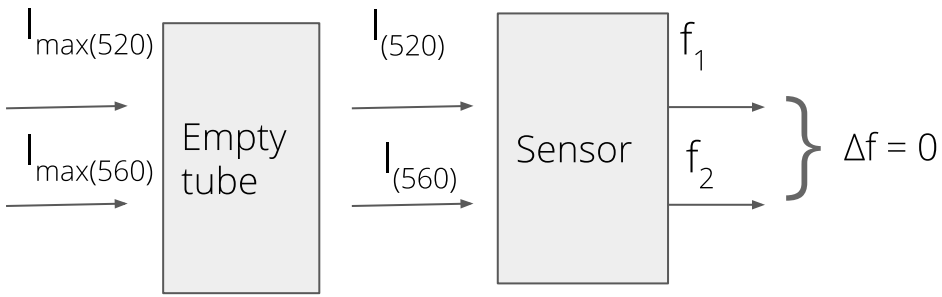
→ Bed leveling

3-point calibration(automated): Release the leveling screws under the bed and when the nozzle presses the bed at a screw tighten it

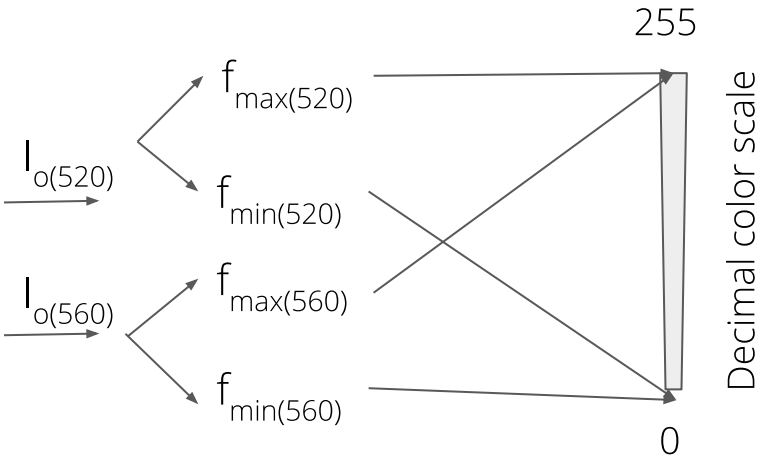
9-point calibration(manual): Slide a A4 paper between the nozzle and the bed. Move the bed up/down still you get slight friction.

Signal conditioning & Calibration

- Zero referencing.
  - Luminous intensity mismatch.
  - For every measurement, a initial referencing to start with.



- Range Mapping
  - Same scale: Relative change in one reading has to be mapped to change in other.



THANK YOU!