

Tunable Light Source

ECE 480

Team 13

Lab Coordinator.....Ruben Alejandro
Manager.....Isaac Davila
Presentation prep.....John Foxworth
Web Designer.....Haosheng Liu
Document Prep.....Cynthia Patrick

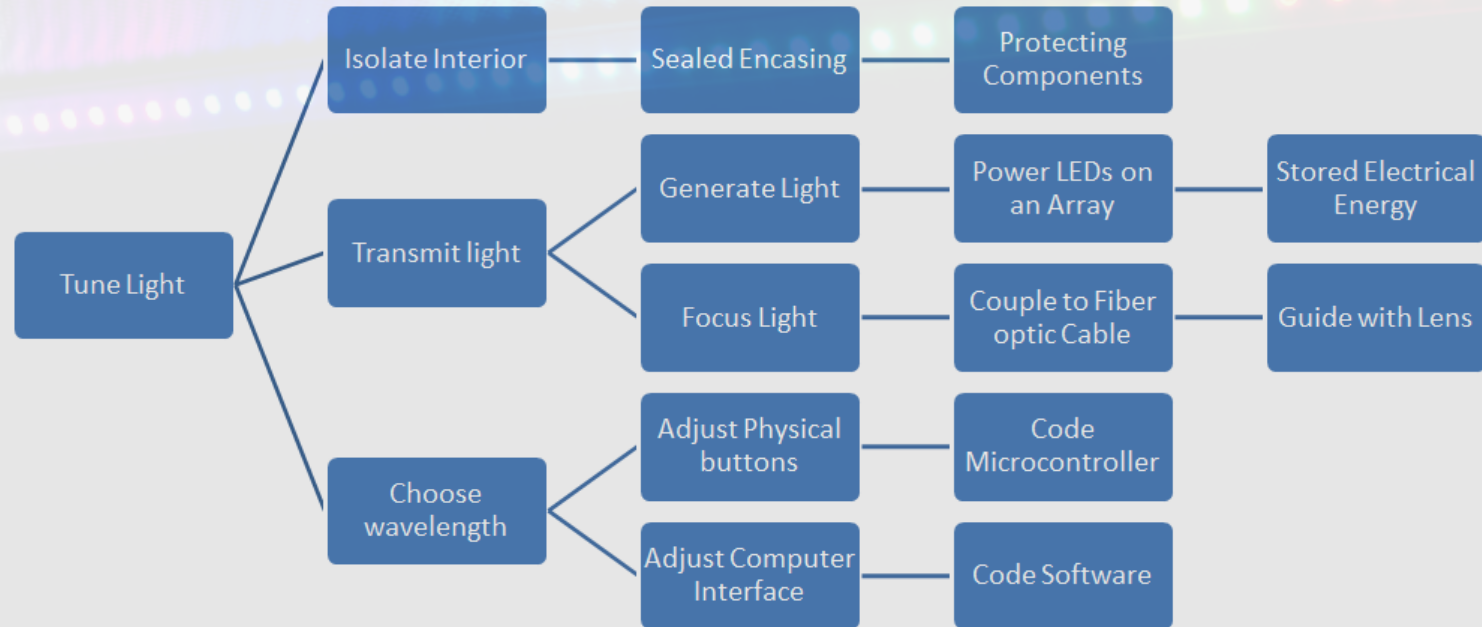
Sponsor: Dr. Chahal

Facilitator: Dr. Ayres

Project Goals

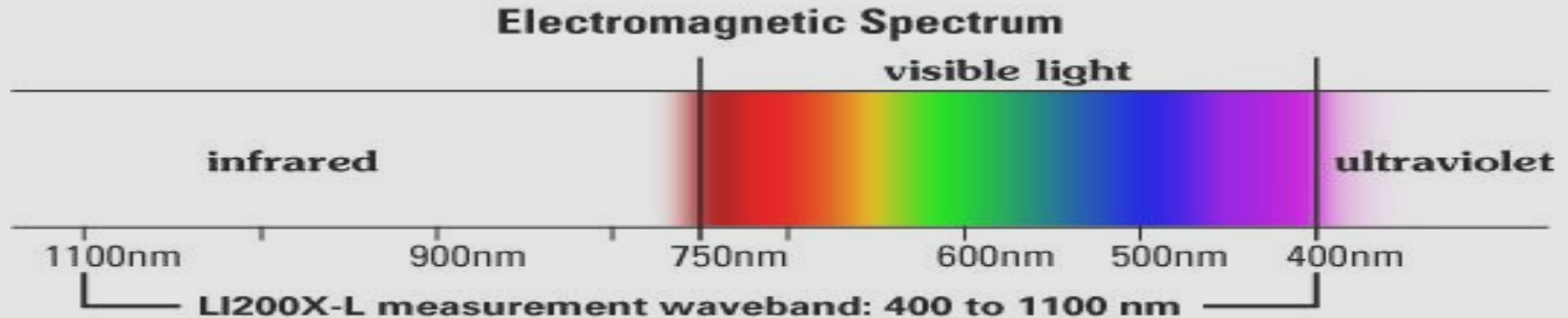
- Create a tunable light source that emulates the black body radiation curve of the sun.
- To be used in solar cell testing, as has potential to be used in a variety of other applications.
- Design is to be low cost, portable, and user friendly.

Fast diagram



Dr. Chahal requires:

- Coverage of the Electromagnetic Spectrum from 400 nm to 1100 nm
- Minimum of 25 peak points
- Illumination of 1 mm²
- 0.1 W output power
- Active control via USB

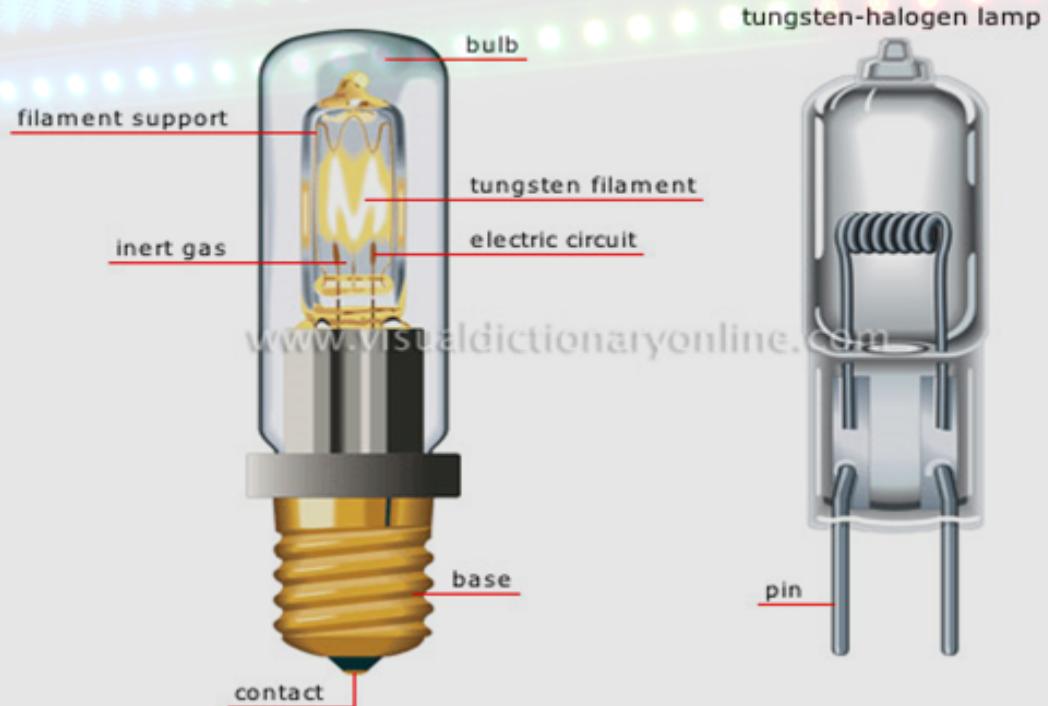


The background features a series of overlapping, semi-transparent light waves in a spectrum of colors: purple, blue, cyan, green, yellow, and red. These waves are positioned in the upper half of the frame. Below them, a horizontal line of small, glowing dots in the same color sequence stretches across the width of the image. The overall effect is a soft, ethereal glow.

Lighting Options

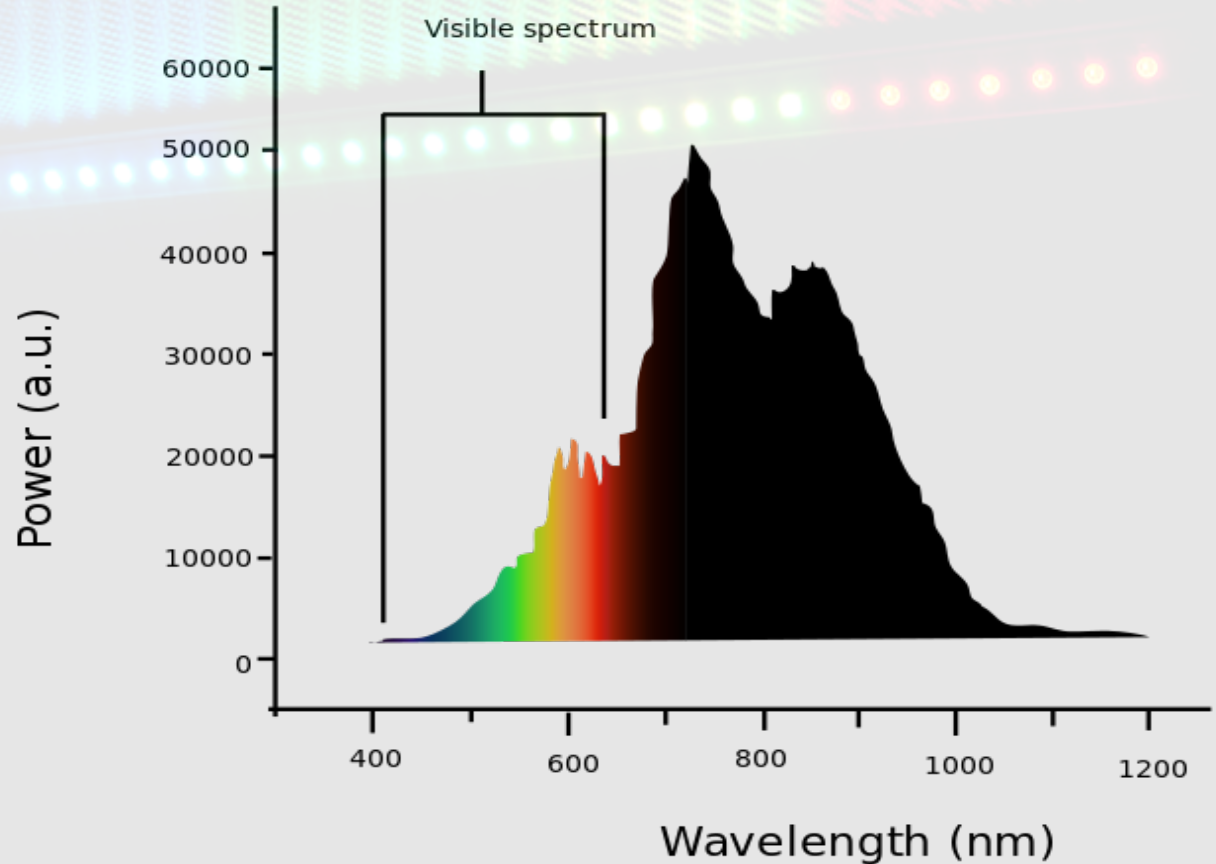
Halogen Lights

- Inexpensive
- Easy to use/install
- Readily available



Halogen Spectrum

- Wideband Continuous Spectrum
- Covers ultraviolet (UV) to Infrared (IR)
- IR = Heat

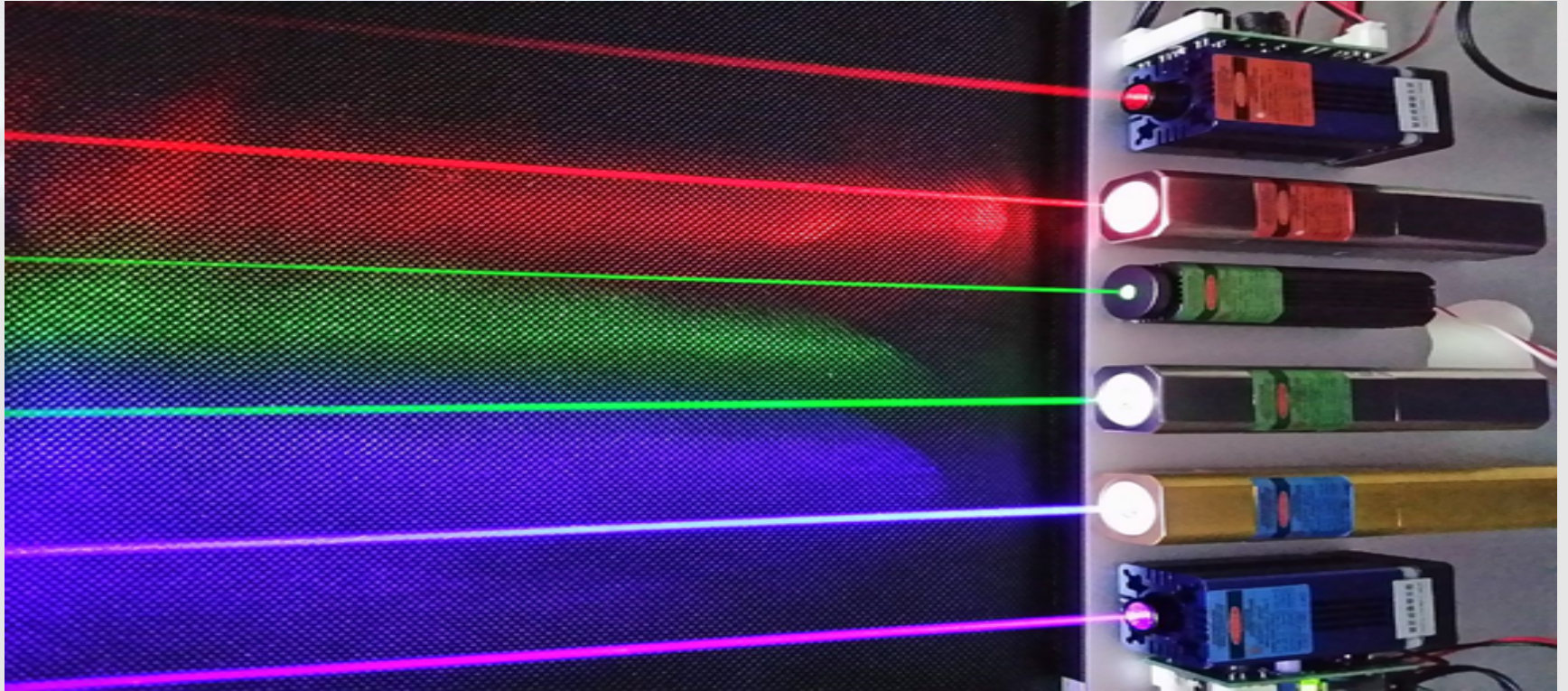


Halogen Light System

- Expensive
- High Power Consumption
- Large

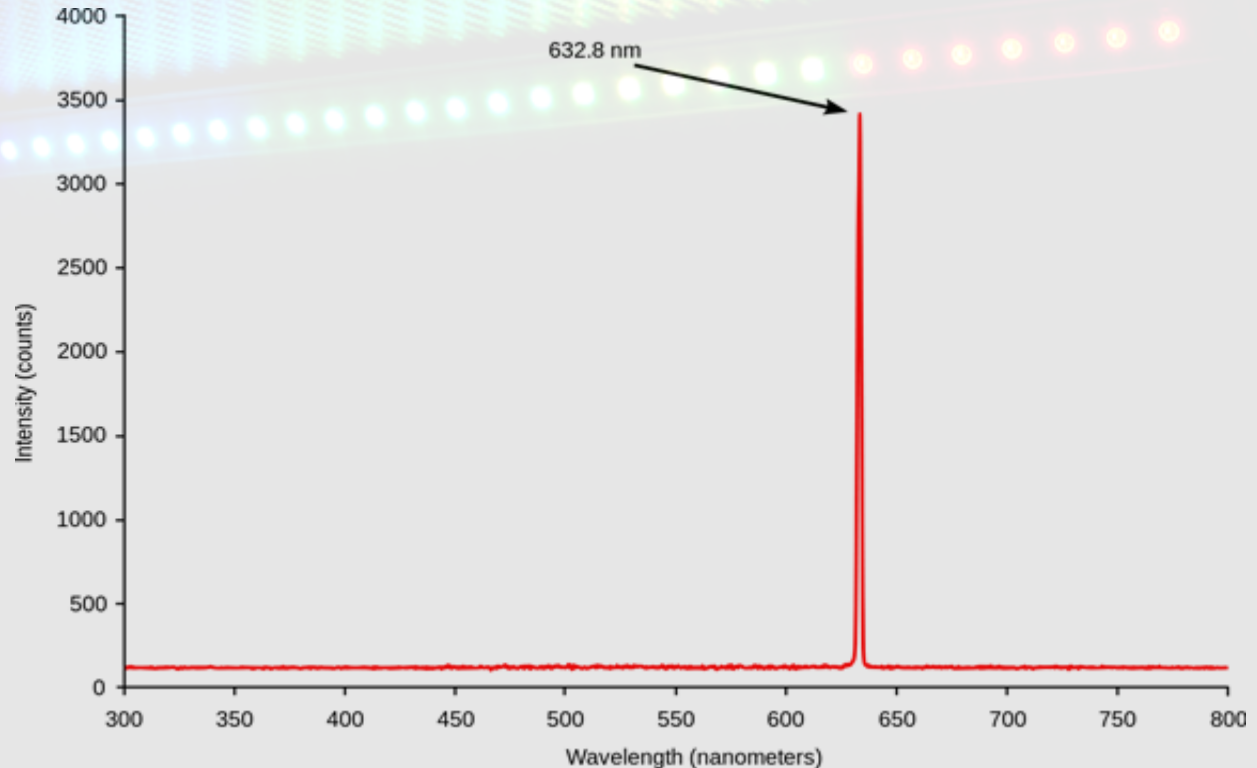


Lasers

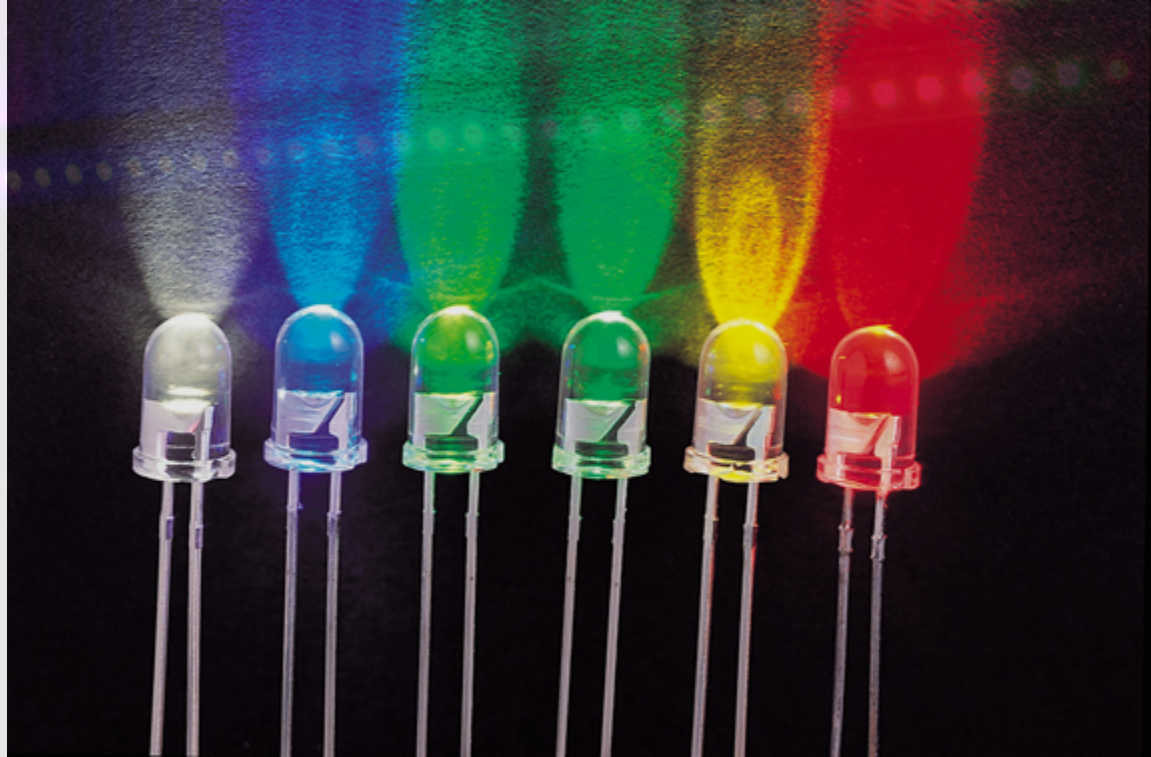


Laser Spectrum

- Emit Narrow band
- Very Powerful Beam

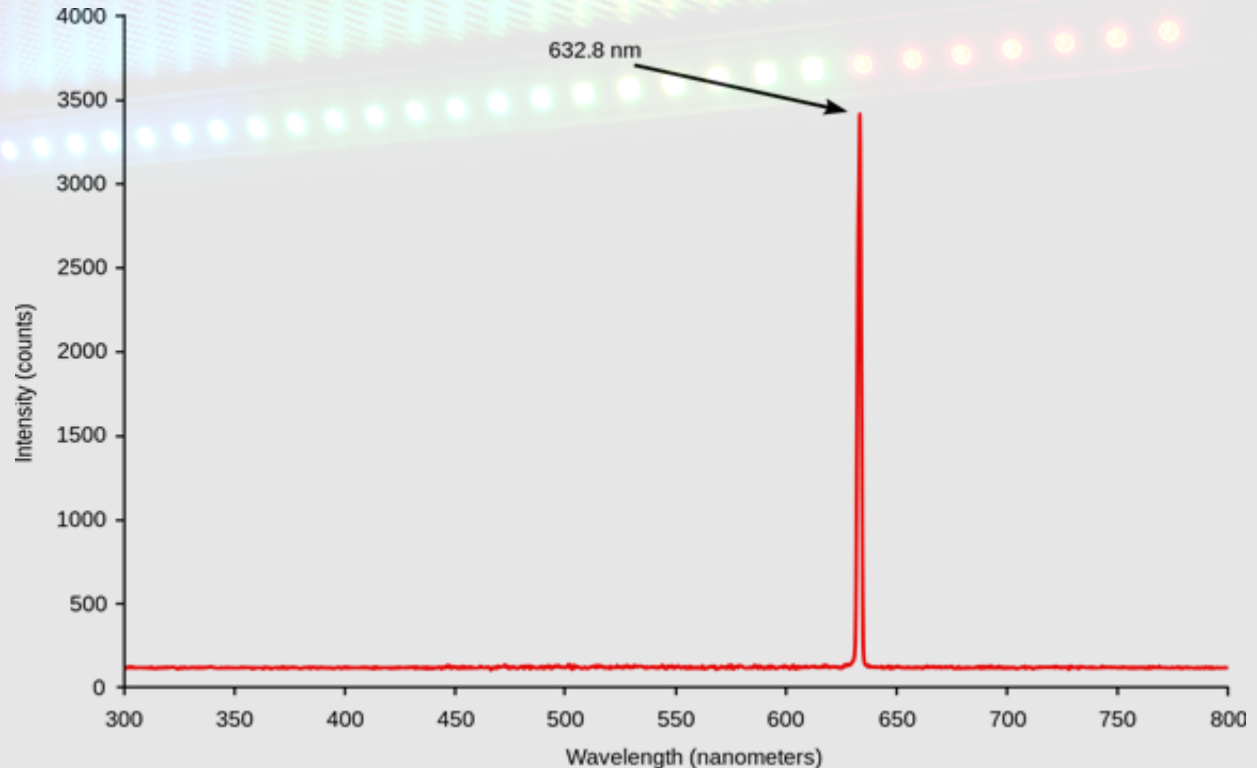


Light Emitting Diodes



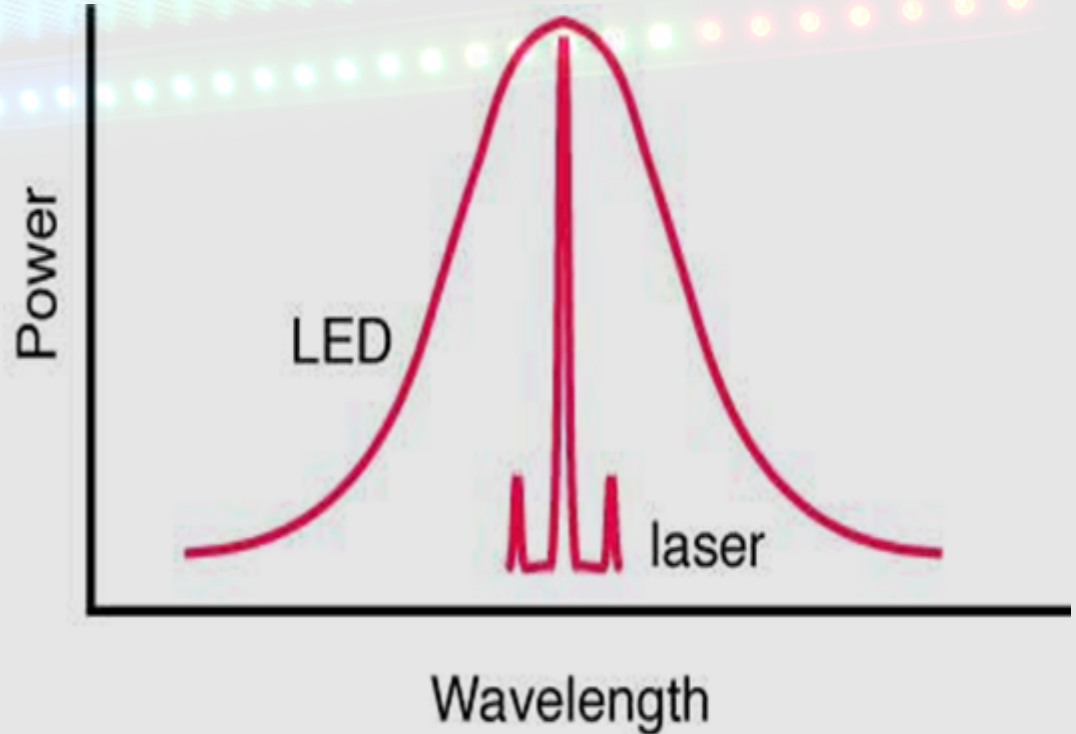
Laser Spectrum

- Emit Narrow band
- Very Powerful Beam
- Large
- Costly

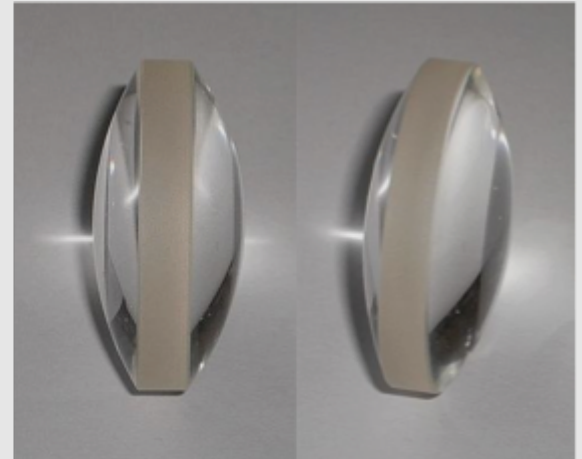
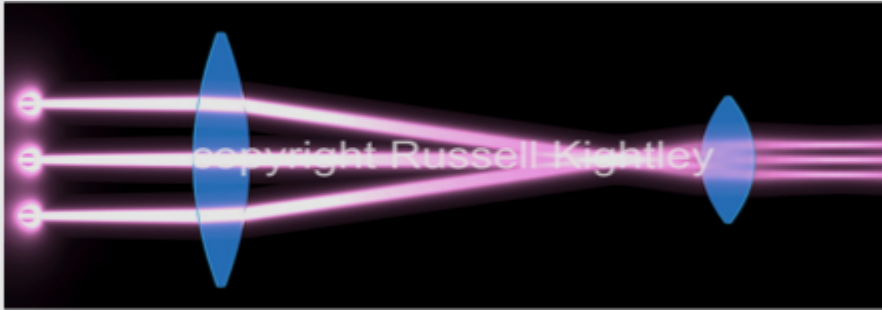


LED Spectrum

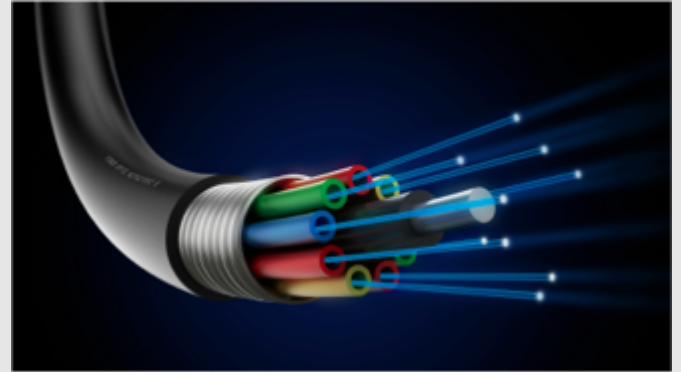
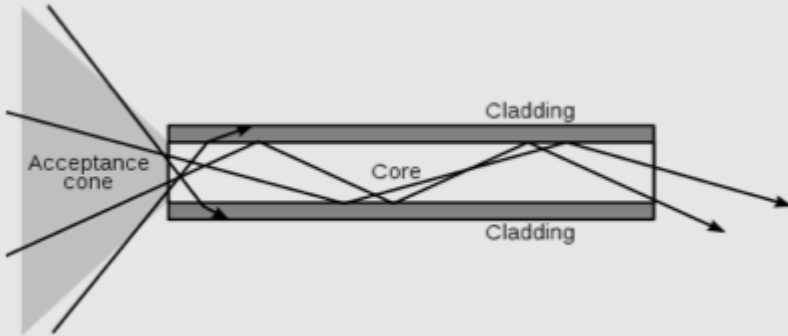
- Small Range of wavelengths
- Inexpensive



Lenses



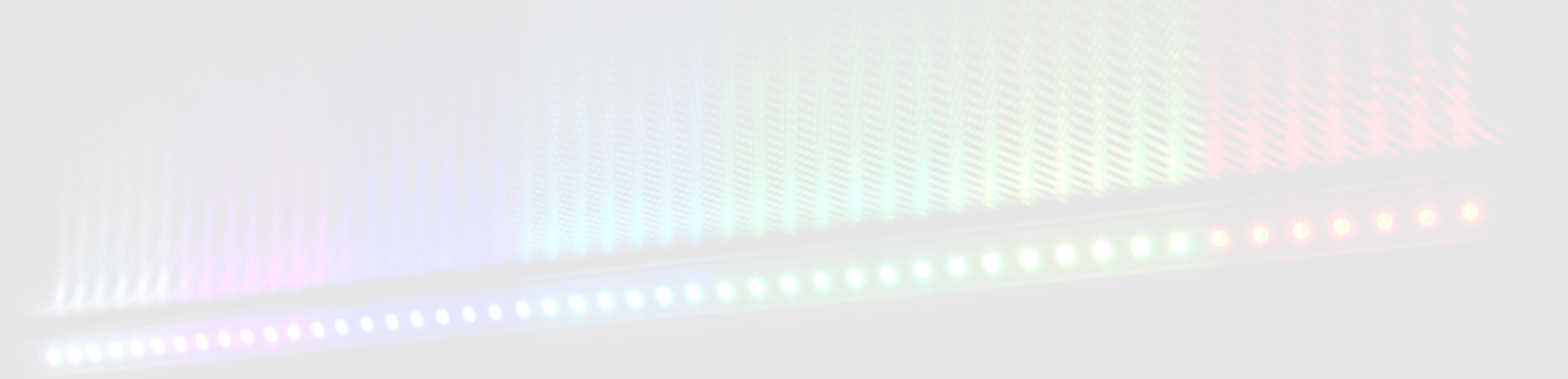
Fiber Optic Cable



Power Supply

- 5 volts output voltage
- 1.5 A output current
- 10000 mAh





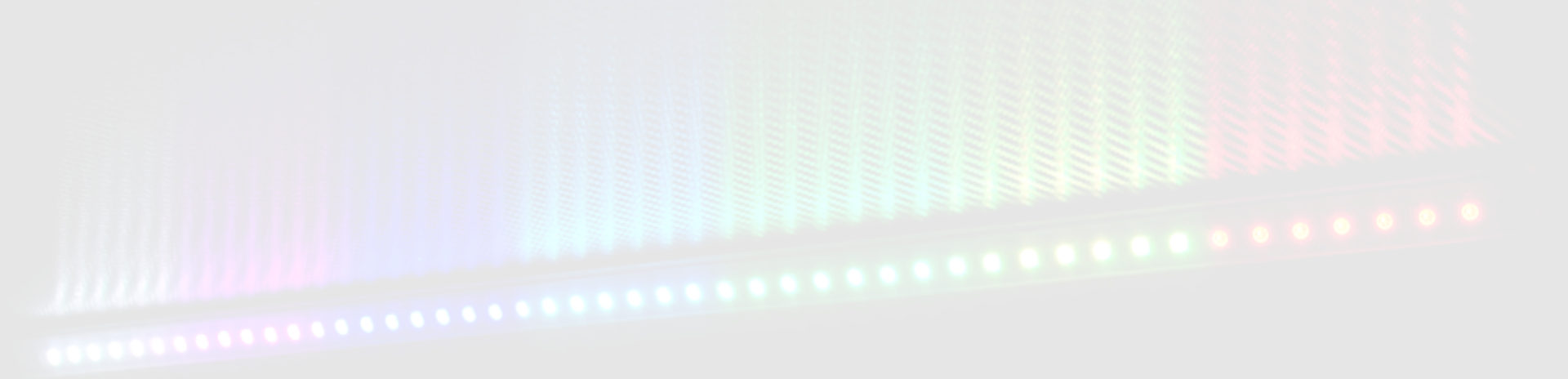
Risk Analysis

Concern:

- Student Use
- Physical Robustness
- All weather operation
- Component lifetimes

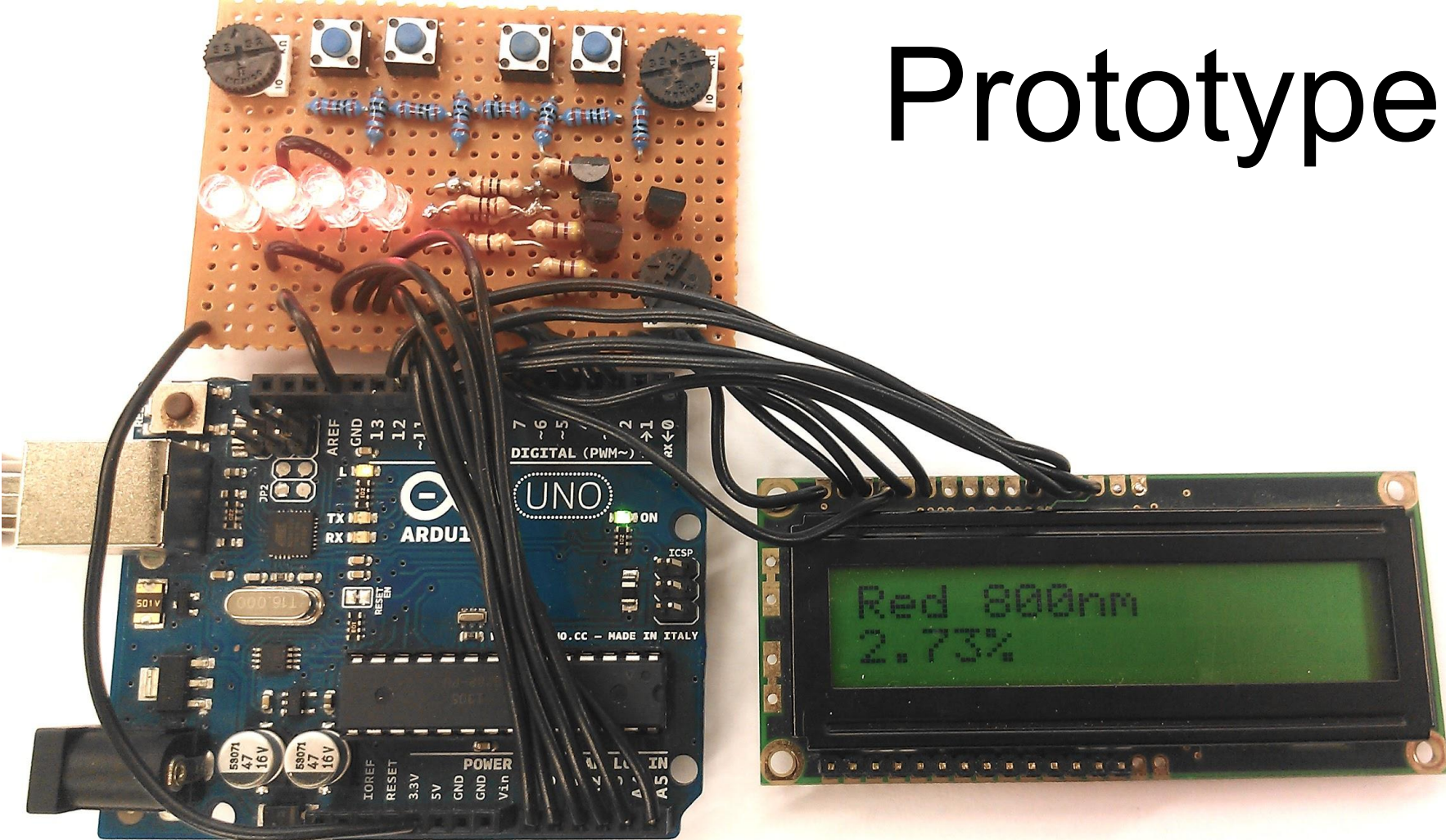
Solution:

- User friendly and accurate
- Secure connections and shock resistant
- Temperature rated components; Water proof
- Easy replacement

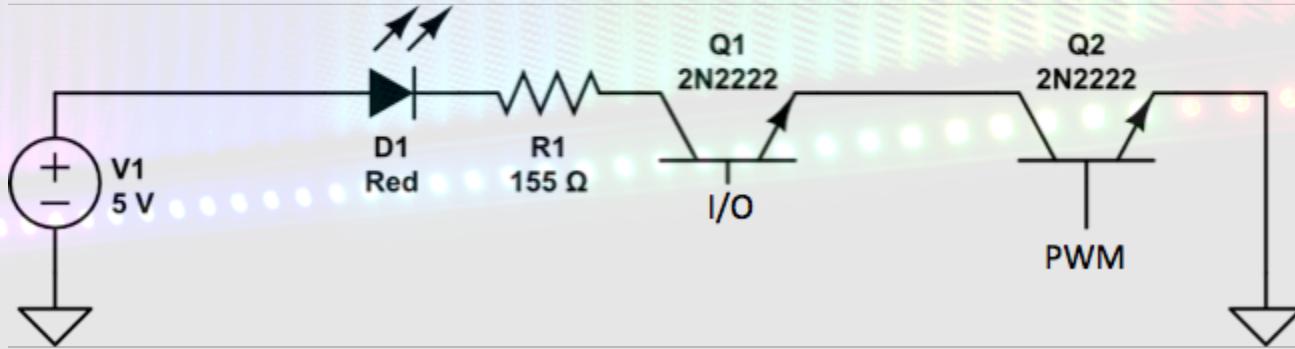


The Design

Prototype

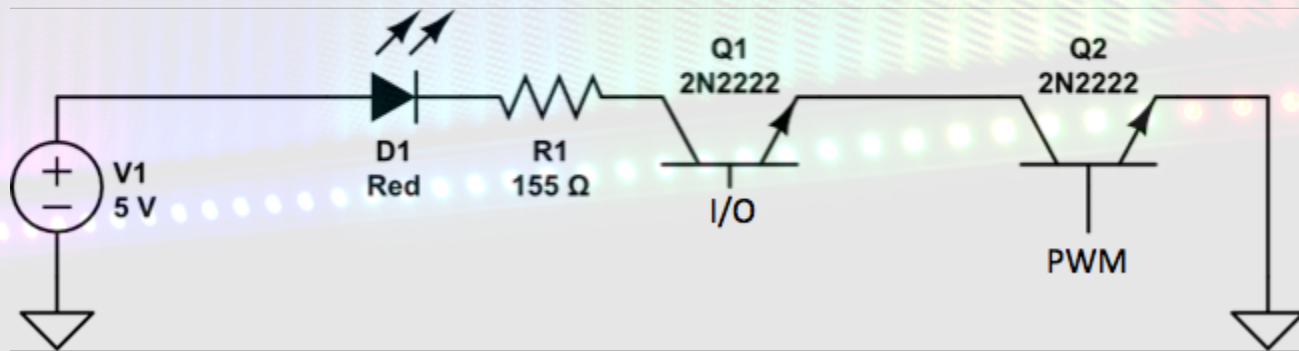


LED Driver

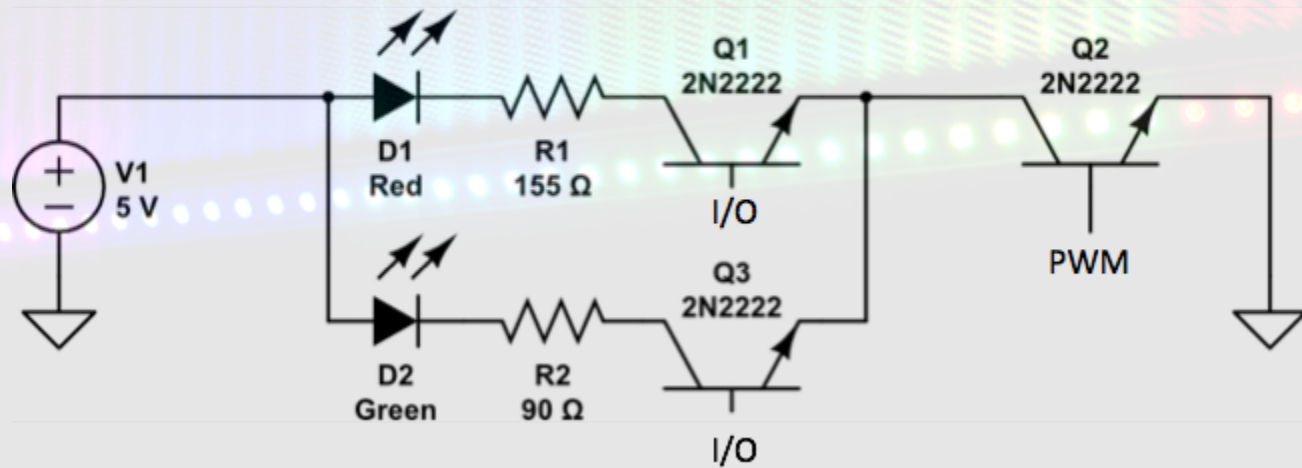


- 5V power supply
- LED (various colors)
- Current limiting resistor
- Two switching transistors (on/off and PWM)

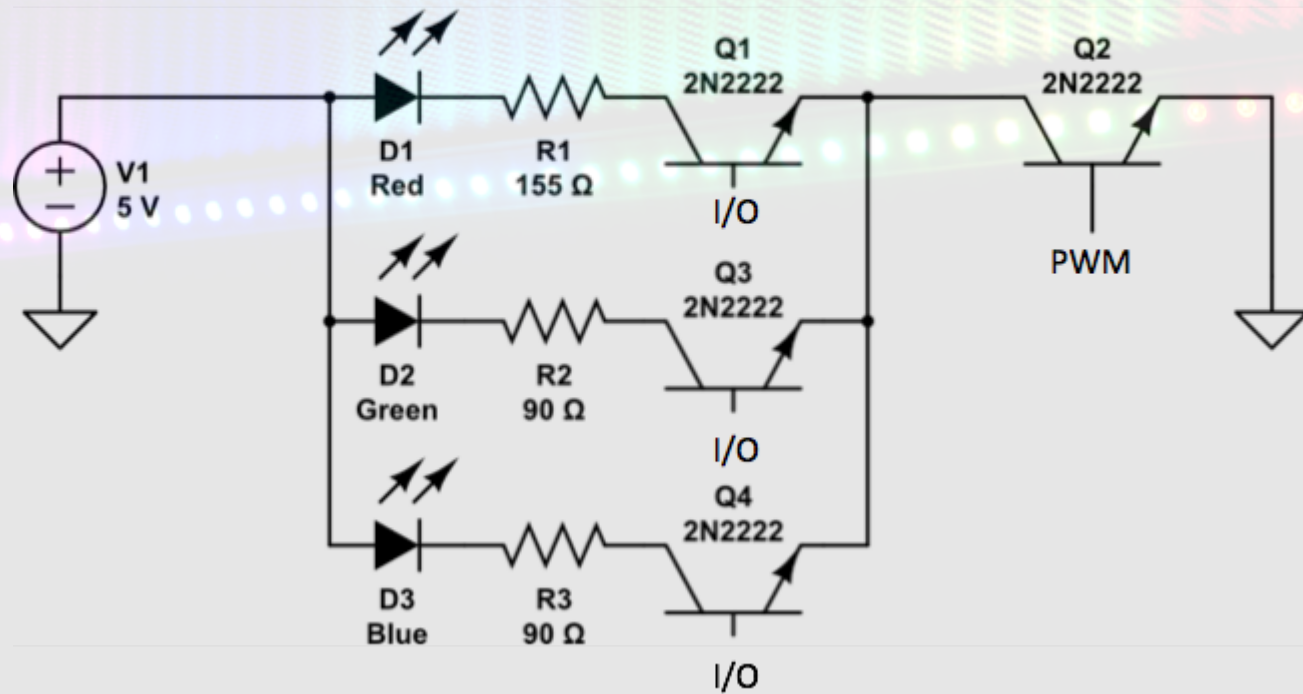
LED Driver



LED Driver



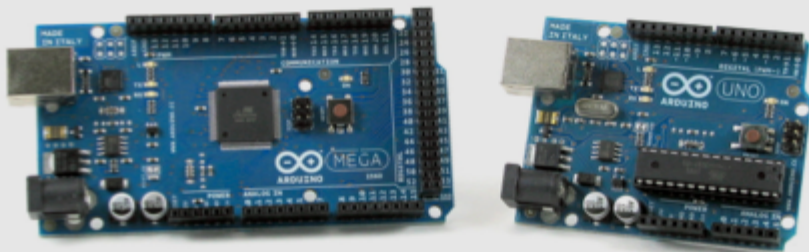
LED Driver



Micro Processor

Arduino Mega 2560

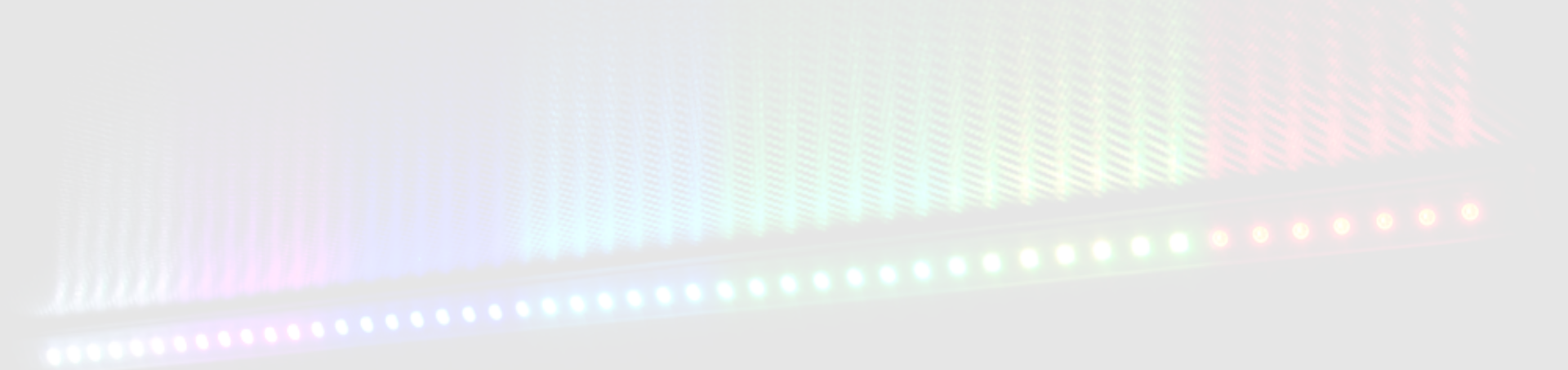
- 54 I/O Pins
- 16 analog input pins
 - 10 bit, 1024 resolution
- 15 PWM compatible pins
 - 980 Hz
 - 8 bit, 256 resolution
- Open source software



Potential for Technology Transfer

- Greenhouse lighting
- Jaundice treatments
- Aid the color blind



An abstract background featuring a spectrum of light waves in shades of blue, green, and red, with a row of colored dots (blue, green, yellow, orange, red) below them.

Questions?