SPIRALING LASERS - Arduino powered Motor Laser Show

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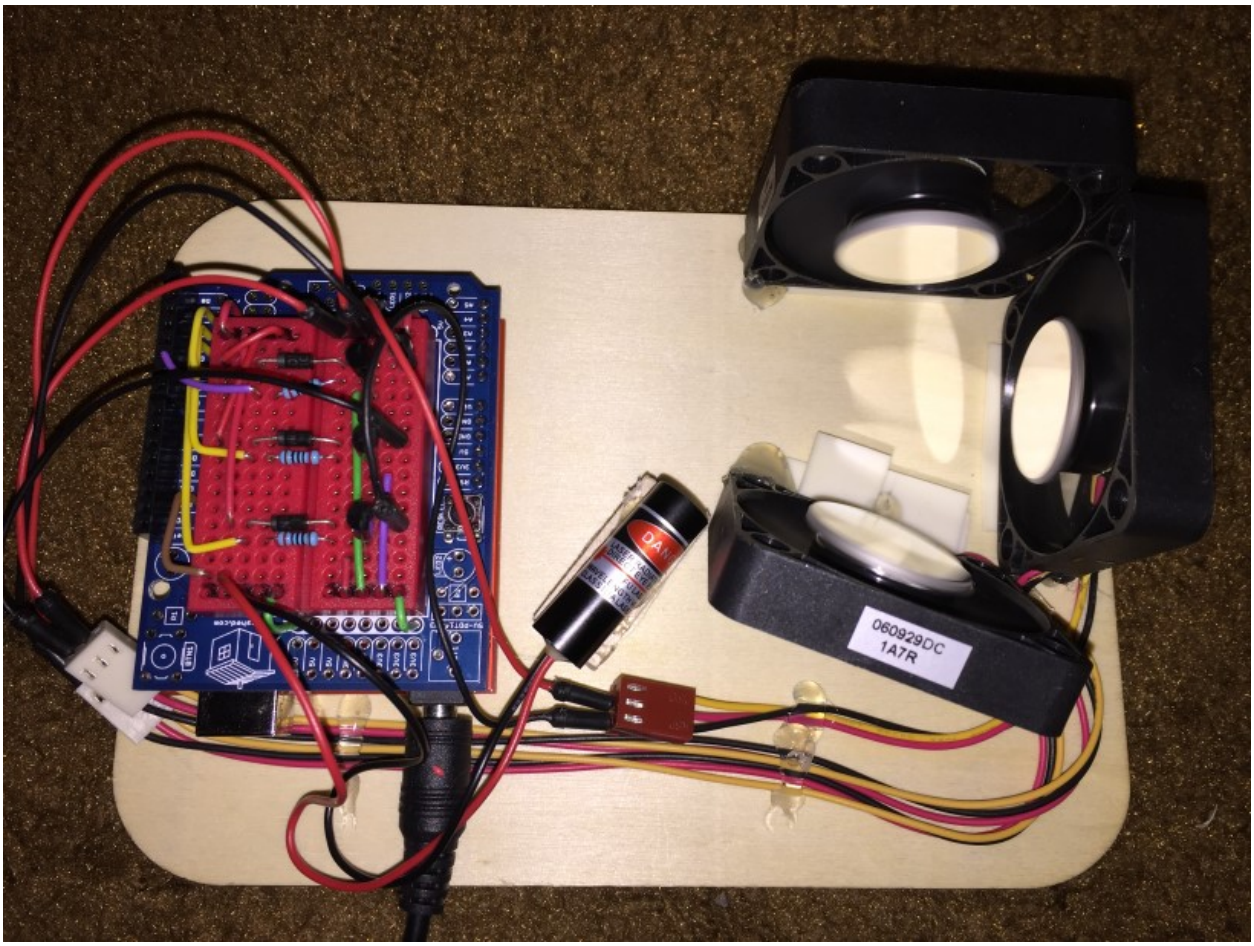
R.Grokett
Kinetic Designs IoT



Overview

There have been several projects building motor/mirror laser light shows, but most use custom electronics or only manual controls. I liked the motor idea, but wanted to control it using a standard Arduino to minimize the unusual hardware and programming work.

This was to compliment my previous laser project, the Laser Lumia Light Show.
http://www.instructables.com/id/Laser-Lumia-Light-Show/

I got the idea after looking at the good design “Laser show for poor man” by AP Digital light at http://www.instructables.com/id/Laser-show-for-poor-man/

That version used a PIC chip, so I wanted to change to using an Arduino. I also opted to have it run fully automated, so eliminated the manual control pots as well as save/restore functions. You just plug it in and sit back!

Warning! *Laser pointers should not be considered as toys. The laser module used here is relatively low powered, but should still avoid any direct eye contact.* ***DO NOT EVER SHINE LASERS INTO ANYONE'S EYES****, including pets, kids, airplanes or yourself. Eye damage is irreversible!*

This is considered a CLASS IIIb laser and **require warning labels** if used publicly.

Parts List

- Arduino Uno
- 9V power supply for Arduino
- Qty 3 - First Surface Mirror 26mm Dia. X 2.8mm thick from American Science & Surplus https://www.sciplus.com
- Qty 3 – Muffin Fans, 12vdc 2” Square from American Science & Surplus https://www.sciplus.com
- Qty 1 - Laser diode such as the 5mw 650nm Red from Adafruit https://www.adafruit.com/products/1054 but any small laser diode should work. 5 to 10mw only!
- Qty 3 – 2N2222 transistors
- Qty 3 – 220 ohm ¼ watt resistors
- Qty 3 – 1N4001 or similar silicon diodes
- Breadboard, wire, box, hot melt glue, etc.
- Arduino IDE 1.6.x
- Software from Github https://github.com/rgrokett/lasershow

Hardware – Assembling Motors/Mirrors

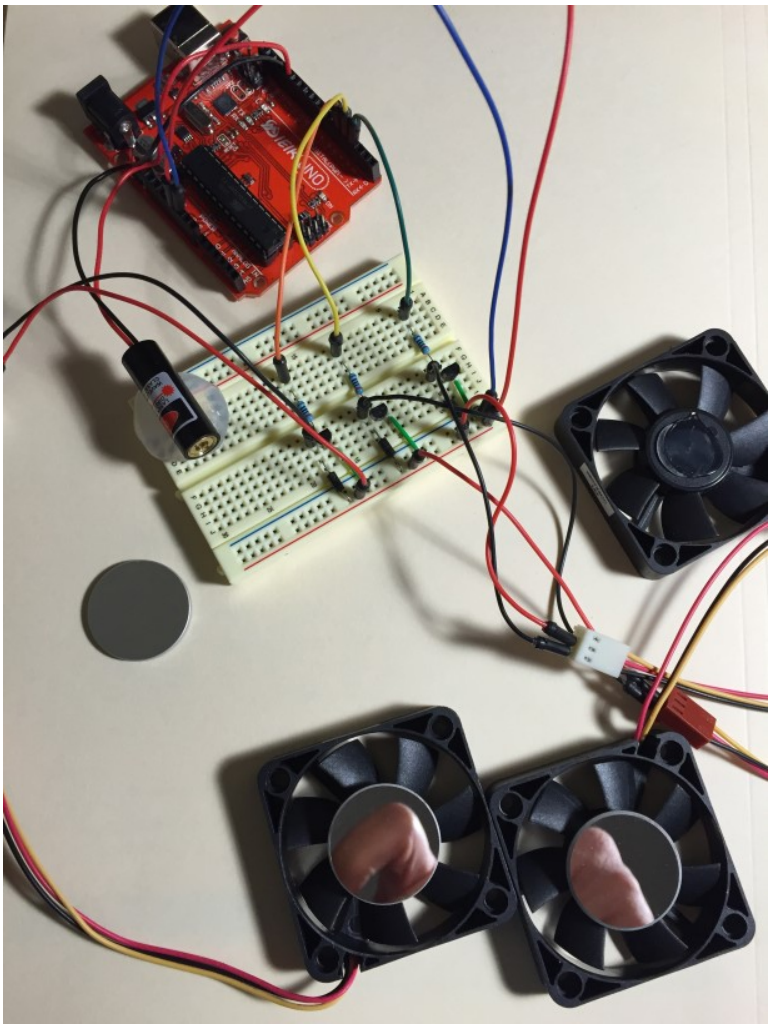
There are two sections to the hardware construction; the fan motor/mirror assembly and the motor driver breadboard assembly.

The mirrors will be mounted on the fans at slight angles using hot melt glue.

The mirrors do not need to be high precision, but do need to be first surface (aka. Front Surface) for best image quality. The ones above were less than $4 each from American Science & Surplus.

You can also search eBay for Front Surface Mirrors but you need to look for unmounted, round mirrors about 25mm to 35mm diameter and 1.5mm to 3mm thick.

One of the mirrors (the last one the laser reflects from) probably needs to be near 35mm, so as to not cut off the beam, but smaller can be used if you use less angle on the first two mirrors.



I mounted the mirrors on the fans using hot melt glue, less than a pea size amount.

NOTE: When you mount the mirror do the following:

- Clean off fingerprints before mounting. Use only a microfiber cloth, no cleaner unless very dirty. Only use DISTILLED WATER to clean front surface mirrors. Lens cleaner can eat coatings or leave streaks.
- Keep the front surface of the mirror facing up. No glue on the mirror!
- Put a drop of hot melt glue on the center of the FAN blades only. Not the mirror.
- Place the mirror as centered as possible, facing up

- Immediately, tilt the mirror just a few degrees, not too much!
- The mirror will stick to the glue almost instantly.
- Turn the fan blade by hand to check the centering and balance. I found that being slightly out of balance doesn't appear to cause much noise or vibration.

If you need to remove and reseat the mirror, gently pry loose using a flat screwdriver or similar tool. *Do not bend the mirror*!

NOTE: Do not mount the fans yet. You need to be able to have the fans and the laser running in order to align. Complete below steps first.

Hardware – Assembling Motor Driver Circuit

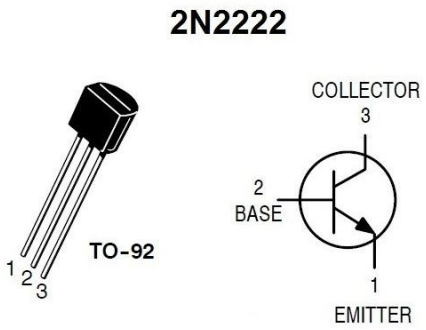
The motors draw too much power for the Arduino to operate directly, so a simple transistor driver circuit is needed. The diodes are to reduce reverse spikes from the fan motors.

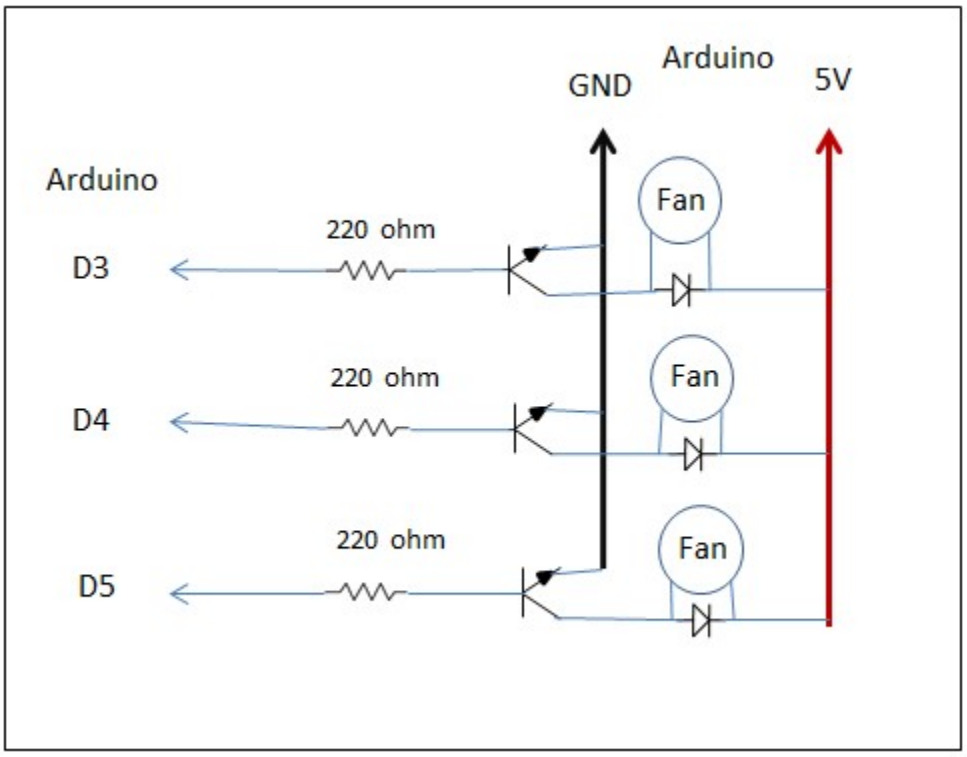
The transistors connect to the PWM pins on the Arduino which controls the speed of the motors.

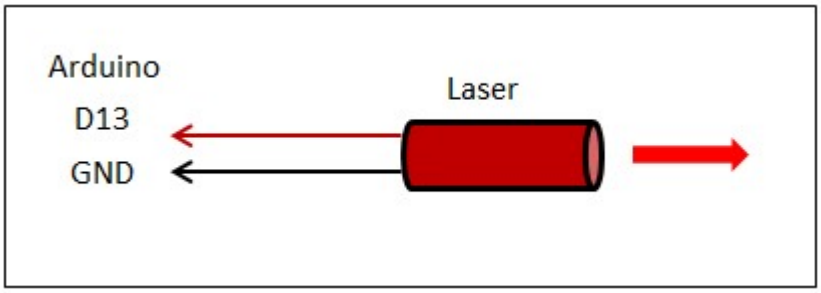
Wire everything as shown in the diagrams below.

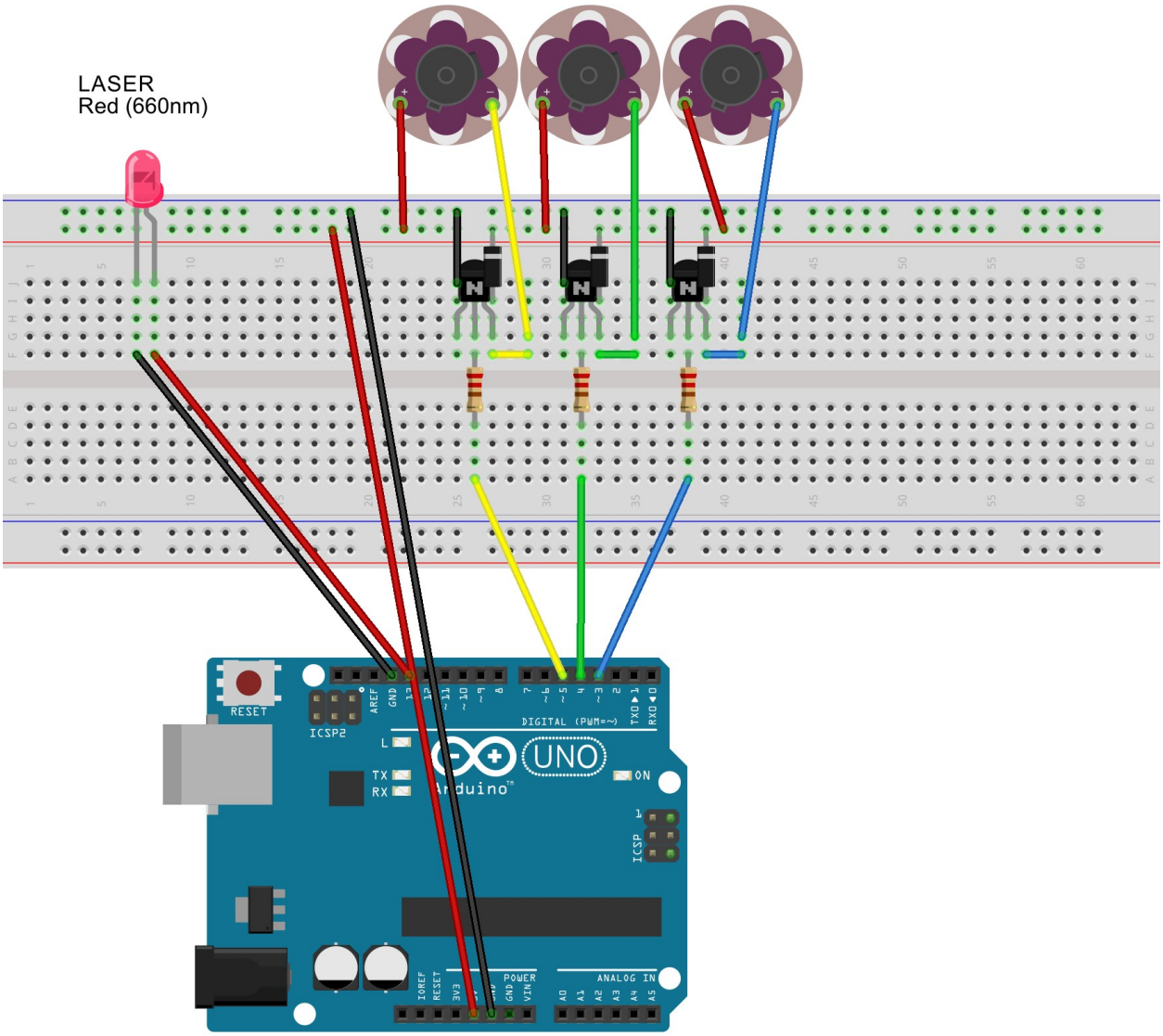
NOTE: You must use a 9V power supply to the Arduino as the USB port probably cannot supply enough current. Plug in the 9V supply and then plug the USB into the PC.

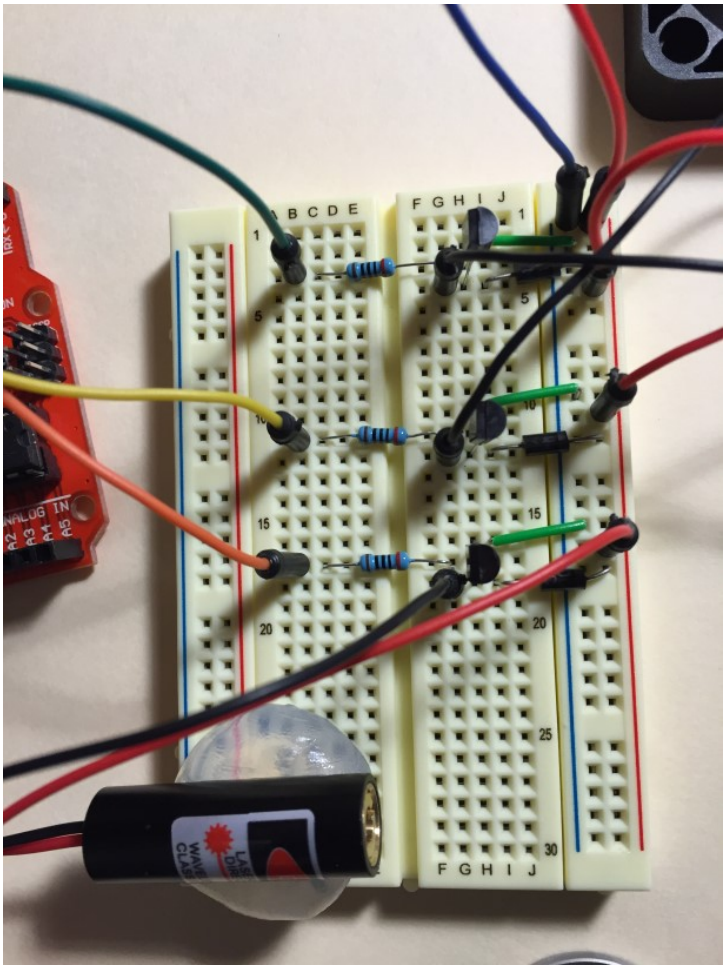
The laser module from Adafruit that I used only draws about 17ma, so is safe to run directly from an Arduino pin. If you use higher power, you may need to build it a driver too. Just replicate one transistor, resistor, and replace the fan/diode with the laser diode.




Arduino
GND
Arduino
5V
Arduino
220 ohm
D3
Fan
220 ohm
D4
Fan
220 ohm
D5
Fan


Arduino
D13
GND
Laser


LASER
Red (660nm)
RESET
ICSP2
DIGITAL (PWM=~)
UNO
TX
RX
ON
ICSP
POWER
ANALOG IN
fritzing



Software

You must have Arduino IDE 1.6.X or higher installed and already be able to upload .ino programs to your Arduino. See https://www.arduino.cc/en/Main/Software for more info.

Download the laser show software from Github:

https://github.com/rgrokett/lasershow

You can download as a zip and unzip to your PC.
Double-click the lasershow.ino program to load it into your IDE. You probably do not need edit anything on the program to get started. Just compile and upload it to your Arduino.

Alignment and Mounting

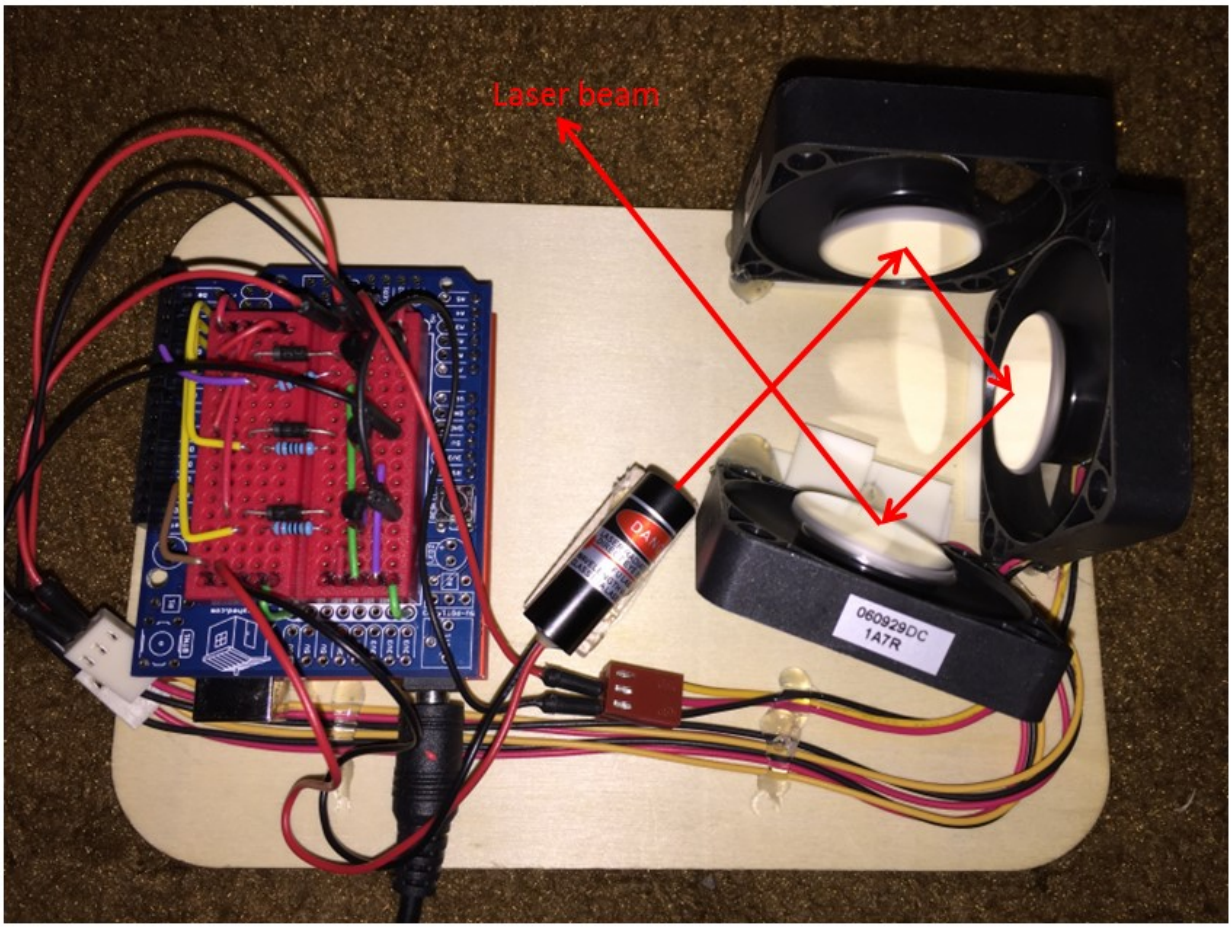
When you download the .ino to the Arduino, it will start executing immediately. You can start the Serial Monitor from the IDE to see some diagnostics. The fans should spin up and the laser should light up after a few seconds.

You can unplug the Arduino from the USB. The PC is no longer needed. Just leave the 9v plugged in.

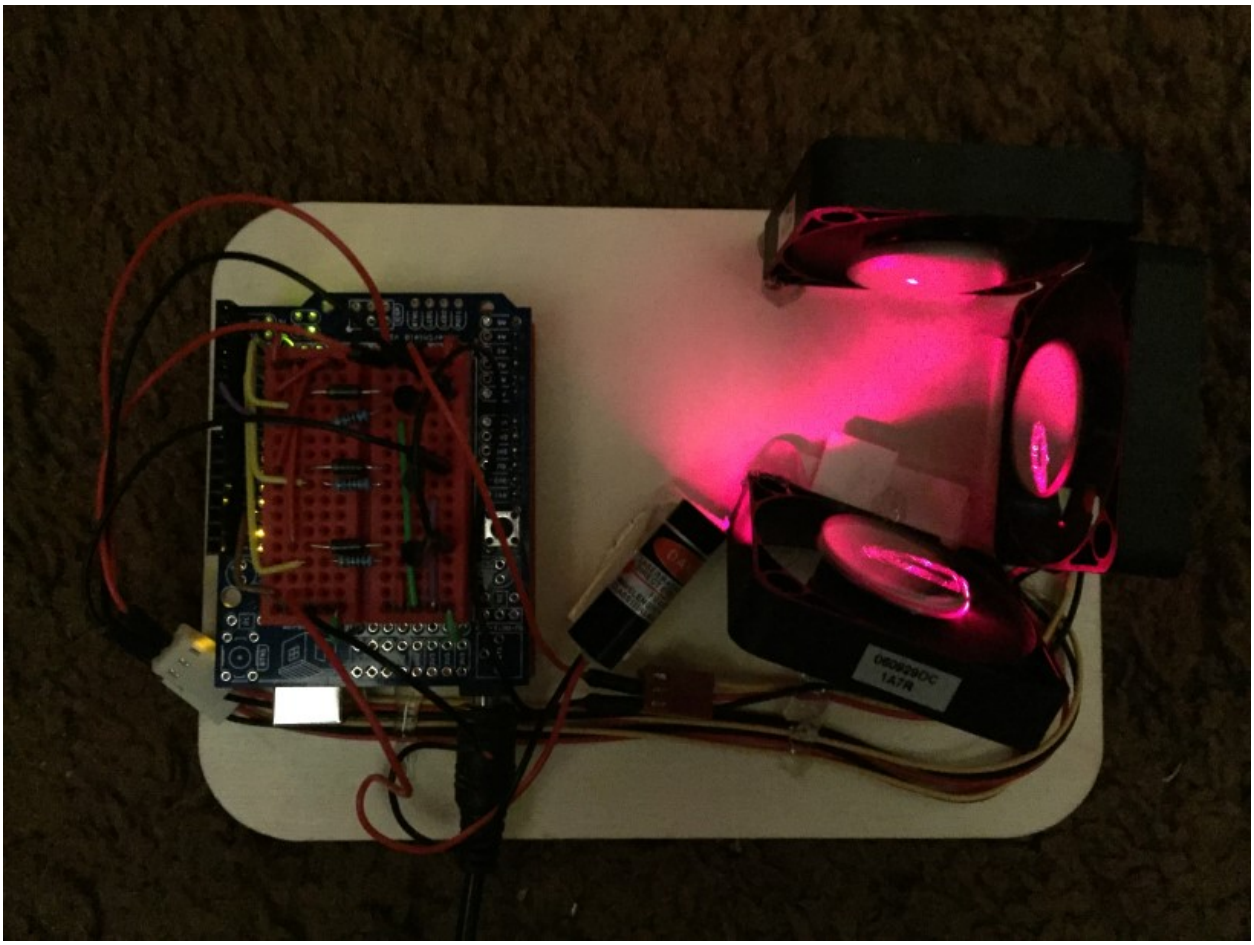
To test the fans/mirrors, bounce the laser off each turning mirror one at a time. Reflect the beam onto a flat surface, NOT YOUR EYES! You should see a CIRCLE. If not, the mirror is not mounted correctly.

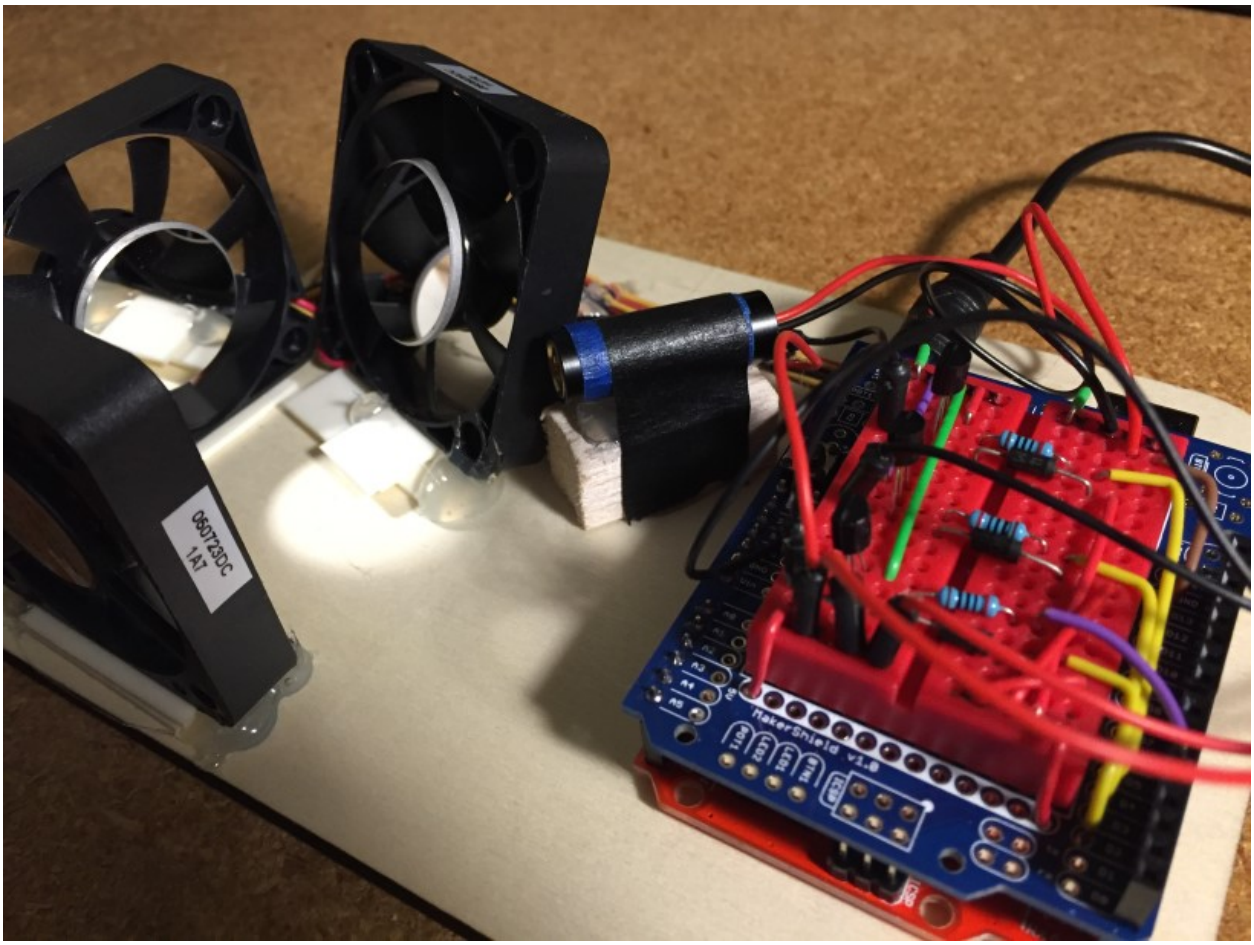
Using double-stick foam tape, temporarily mount the fans, arranged similar to below. Final adjustment comes as you glue everything down.

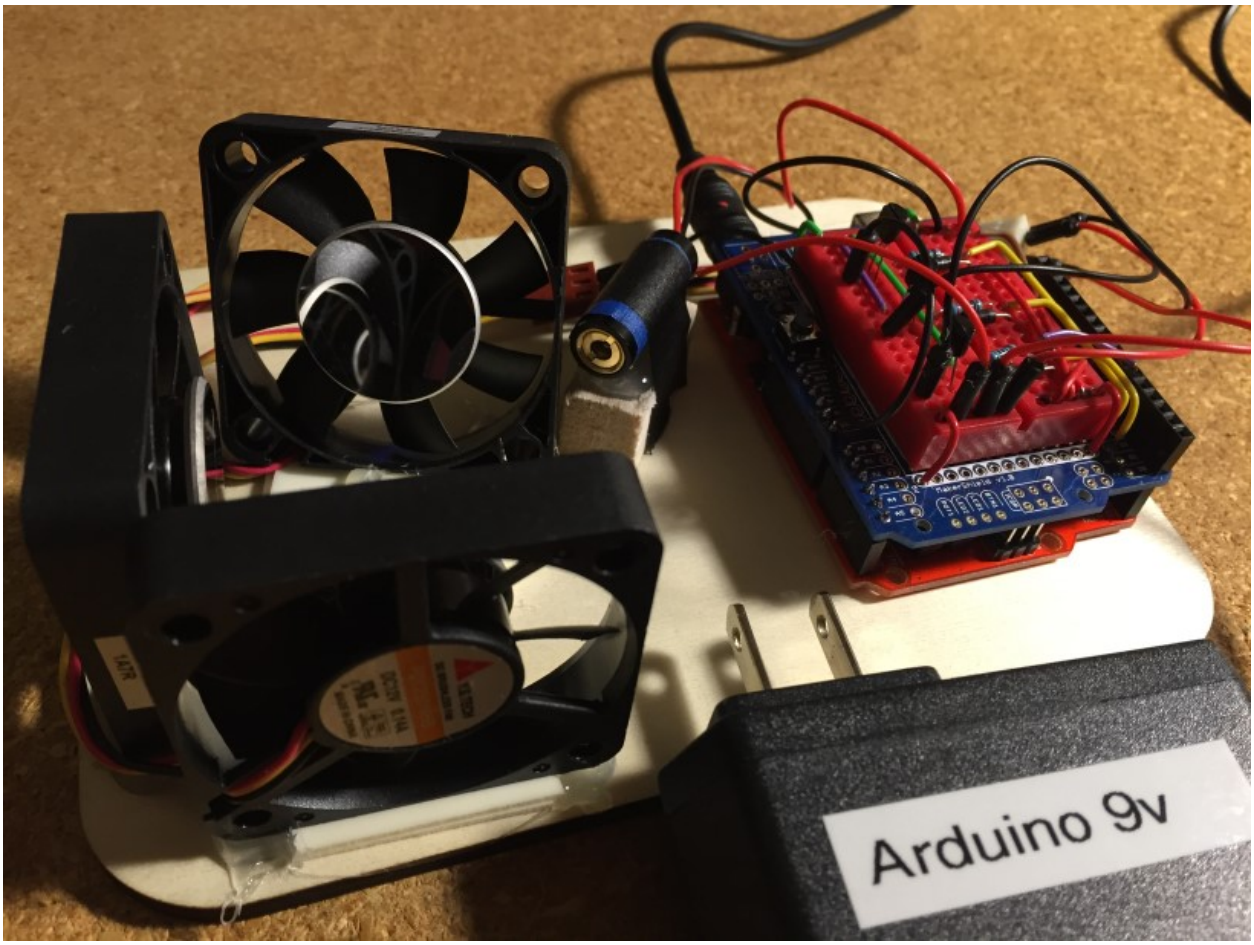
The Laser is mounted on a small board, about a half inch above the table. Angle it to bounce off approximately the center of each mirror.



Once you are satisfied with the alignment, hot melt glue everything down in place.



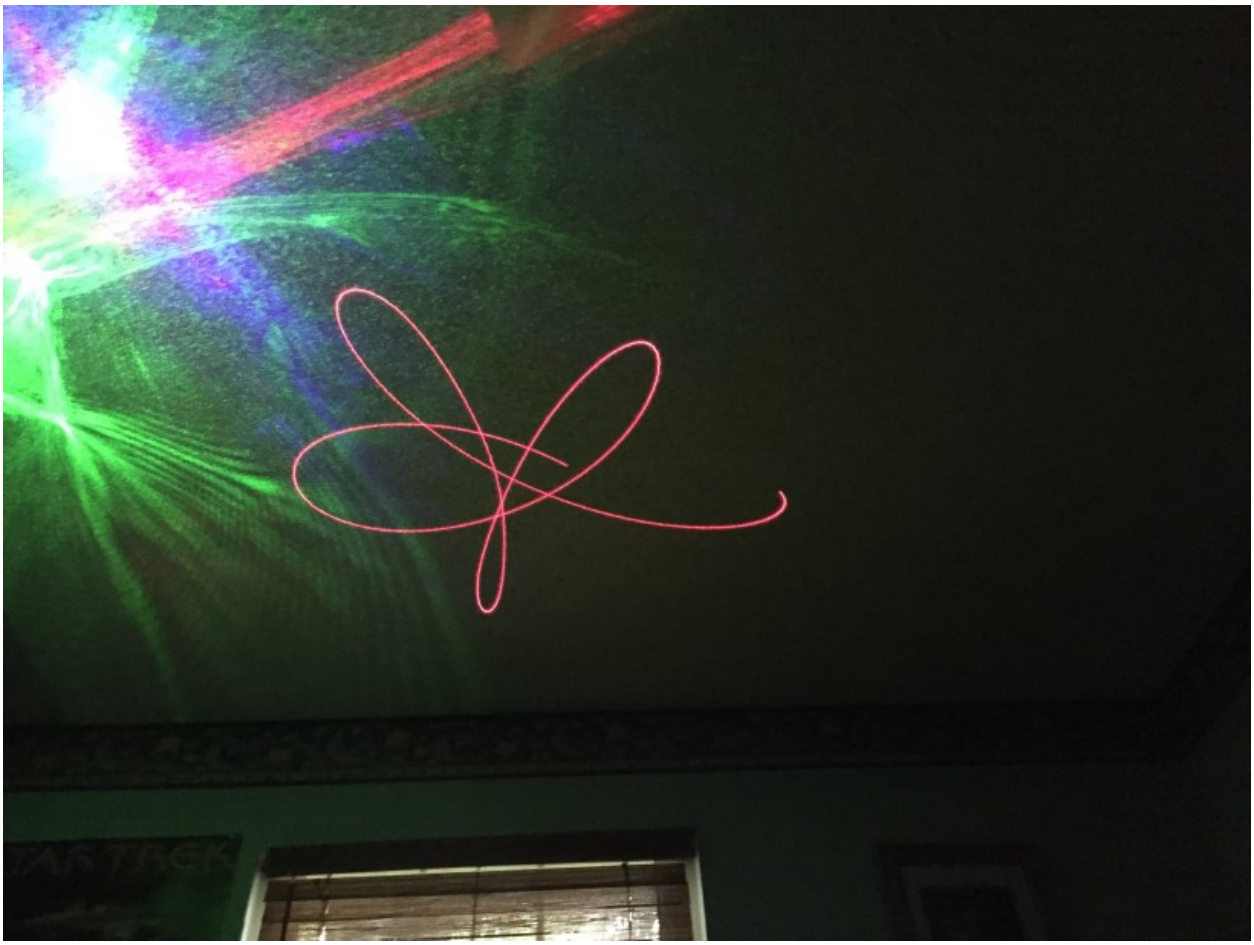

0507Z3DC
1A7
MakerShield v1.3



Operation

Simple, just point the unit at a wall or ceiling and plug it in. The software will start automatically in a couple seconds. Put on some music, sit back and watch the show!

You can mount the unit into a box with a clear plastic window in it to keep dust out.



Here’s a photo with my laser lumia running as well.
http://www.instructables.com/id/Laser-Lumia-Light-Show/

Feel free to modify the software to add other features.

HAVE FUN!