Motor Controller

The objective of this project is to control the speed of a motor, by adjusting the duty cycle of a Pulse Width Modulated (PWM) signal. The kit for this project consists of a motor with a built in tachometer, a small circuit to convert the tachometer signal to a digital signal and a motor driver to allow the Arduino to drive the motor. An RPM readout (LCD) and speed control (encoder knob) will be expected.

The motor controller that is part of this kit is the Pololu 2137 (https://www.pololu.com/product/2137), which is a dual H-bridge. This design only uses one of the H-bridges, so it is recommended that the inputs to the extra bridge, In3 and In4, be hooked to ground and the outputs, Out3 and Out4, should be left open (not connected to anything).

Some of the details of computing RPM from the tachometer signal, requires a couple important points. First the tachometer produces 8 cycles per revolution, so if you measure the cycle time (Δt) in μseconds from rising edge to rising edge you will compute RPM as

$$RPM = 60{,}000{,}000\left(\frac{\mu sec}{minute}\right) * \frac{1}{8 * \Delta t}\left(\frac{Rev}{\mu sec}\right)$$

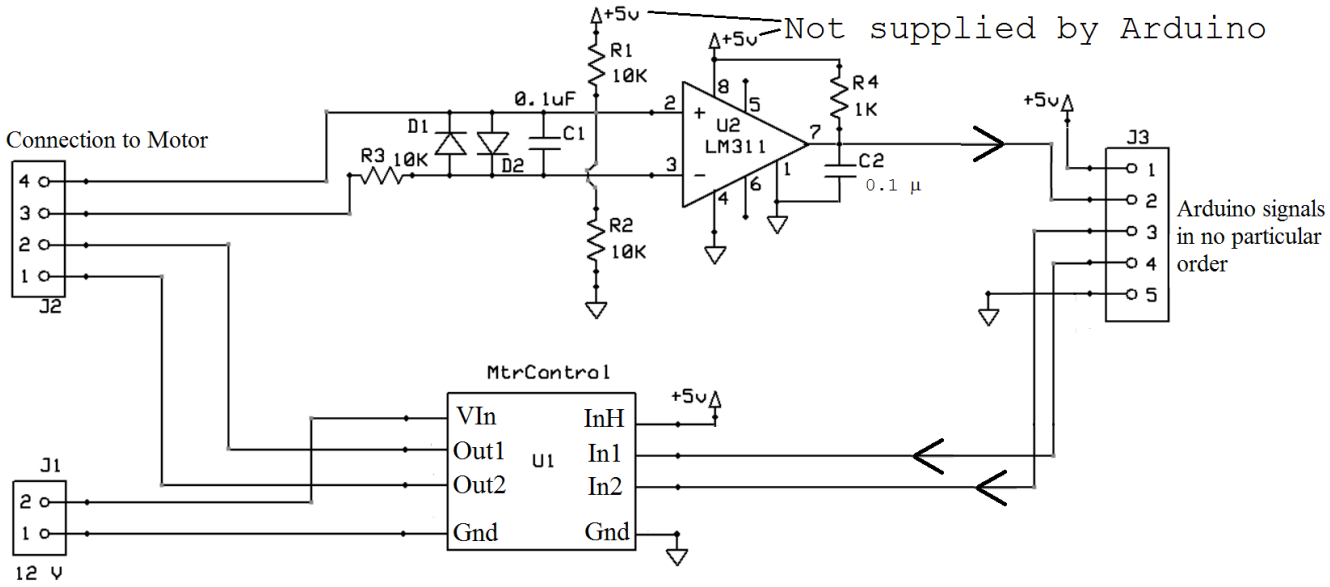


Figure Proj-1A. Schematic for the Motor Controller.

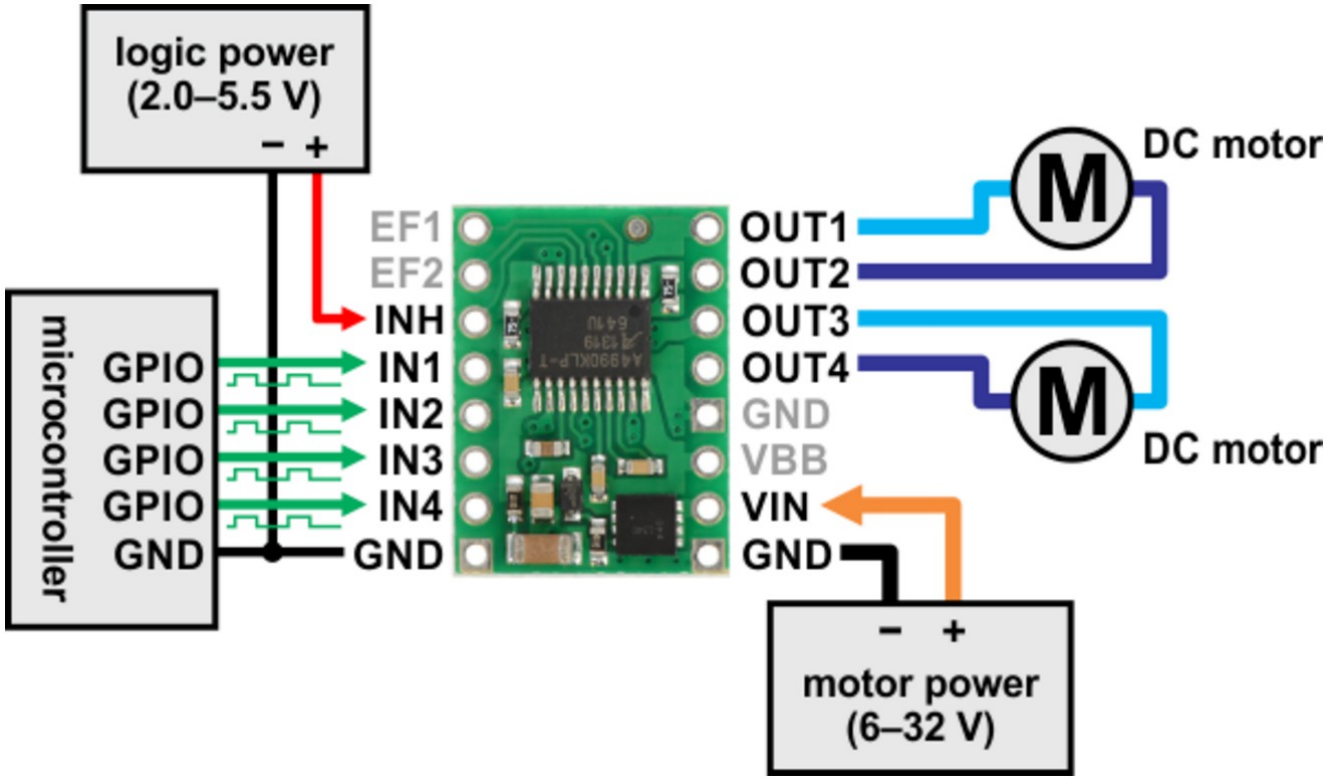


Figure Proj-1B. Vendors Basic Circuit for Driver.

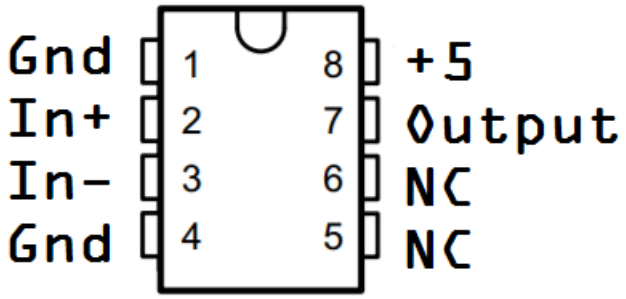


Figure Proj-1C. Pin Numbering on LM311.

Solar Tracker

The objective of this project is use a servo motor to turn a set of light sensors towards a light source. This system could be used to keep a solar cell pointed directly at the sun. A time of day and angle readout (LCD) are expected.

Consider the voltage on pin 3 (coming from between R1 and R2) as the measure of the total light present. Then if this voltage is too high, indicating that there is not enough light, you should set the position of the servo based on the time of day. For simplicity, simply set the position to 0 for 6 AM, 180 for 6 PM and linearly in between. Note that for after 6 PM, it should simply move to 0 in anticipation.

If the total light is sufficient, you should move the servo, such that voltage on pin 4 (from between R2 and R3) is approximately half of the voltage on pin 3.

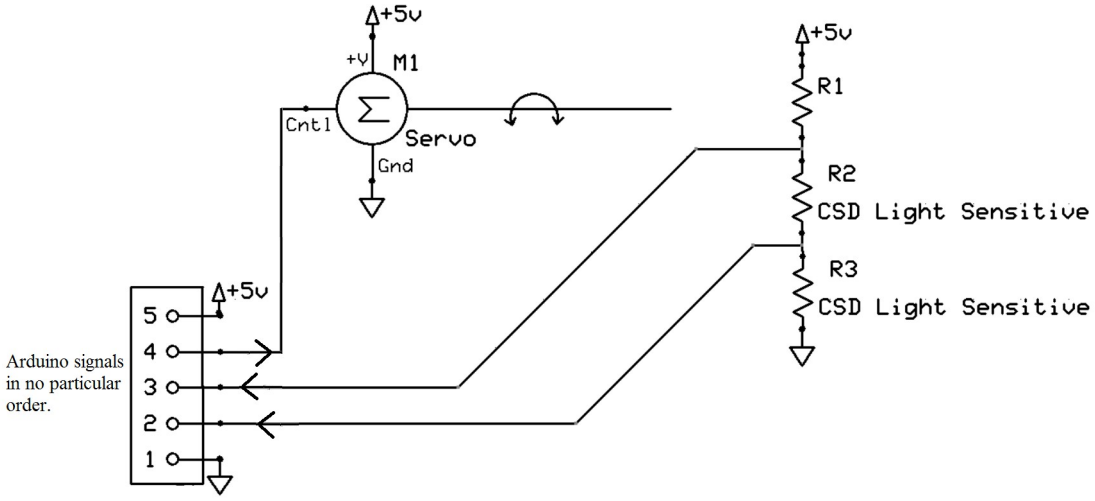


Figure Proj-2A. Schematic for the Solar Tracker.

Figure Proj-2B. Mounting of Light Sensors and Board to Motor

Dispenser

The objective of this project is to turn the stepper motor a set number of revolutions, each time the opto-interrupter shows open. This system might be used to dispense towels in a restroom.

Note it should not keep rotating the motor if the opto-interrupter is stuck open. Rather you should stop the motion (once a complete number of revolutions), and show an error message. However if a user wants to override this case, if the push button is pressed it should again turn the motor the correct number of revolutions and respond as before.

As an extra note, the stepper motor sold in the kit has 96 steps per revolution. Also, the driver chosen for this has two H-bridges to drive the two windings of the stepper motor.

Also the encoder should be used to set the number of revolutions that the motor will move for a given cycle. The number of cycles and status messages are to be displayed on the LCD.

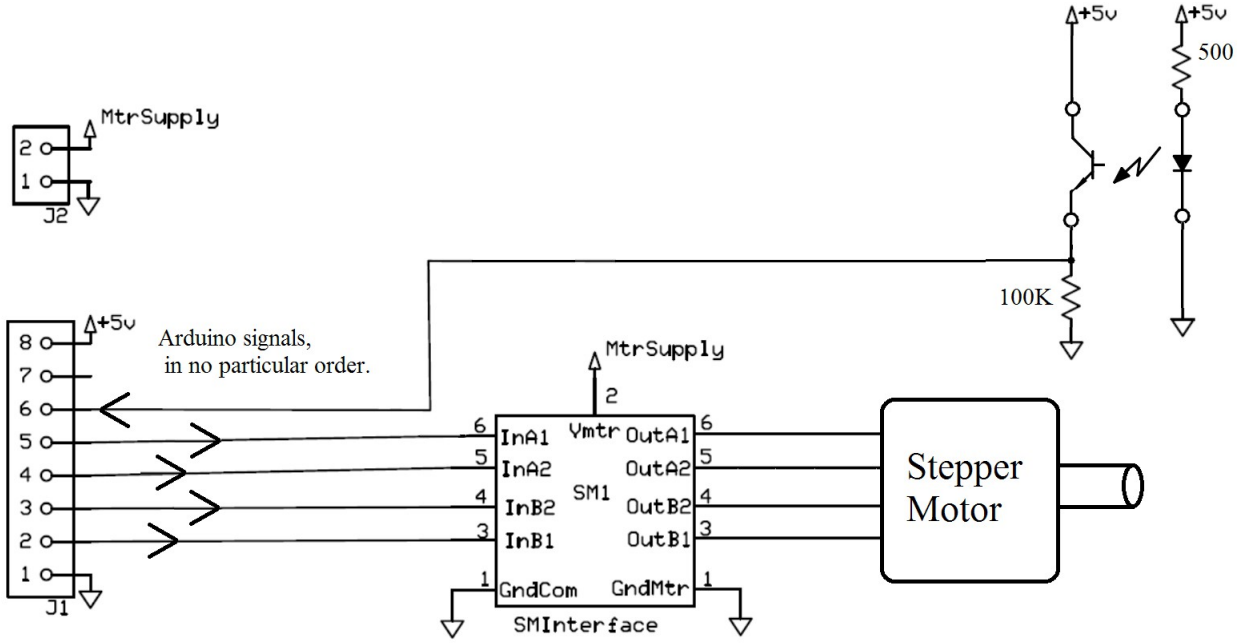
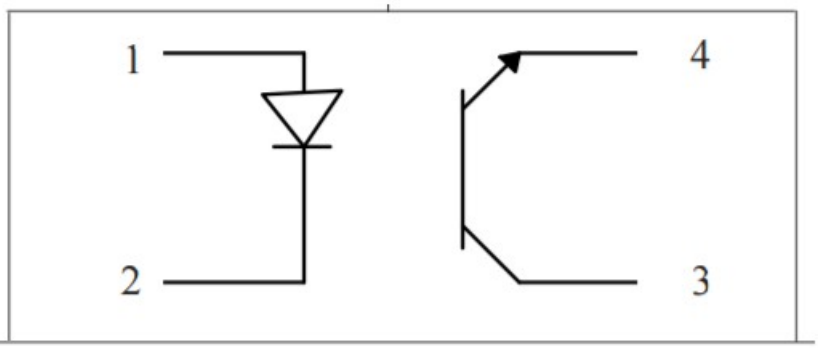
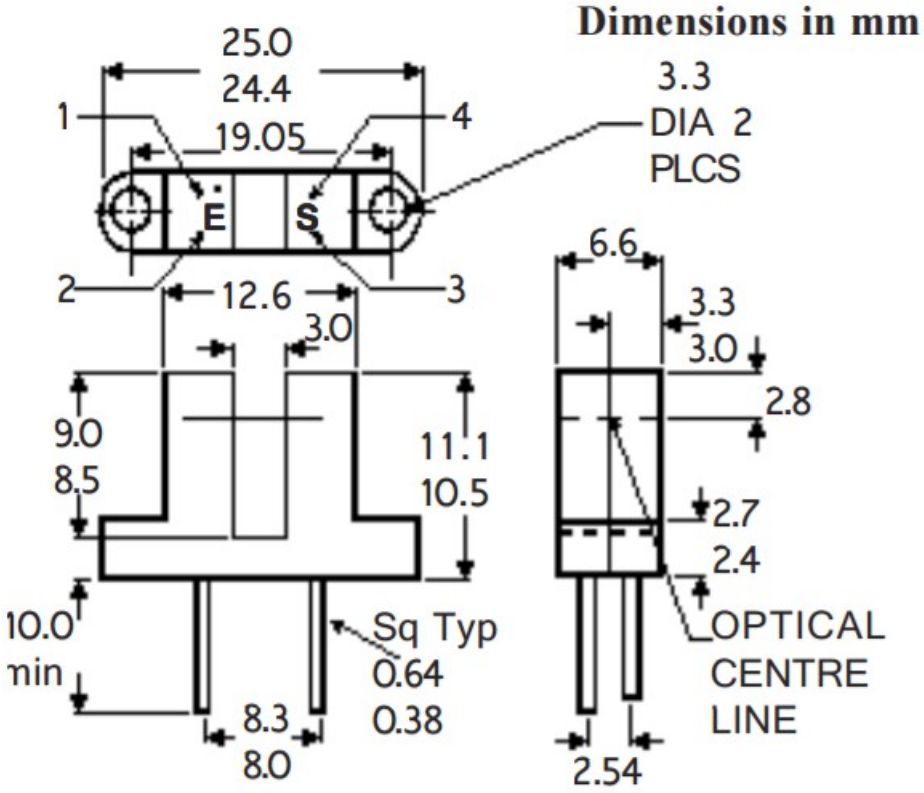


Figure Proj-3A. Schematic for the Dispenser.

Physical Pin Out for OptoInterrupter

H21A Type Device will be Marked " H21A "





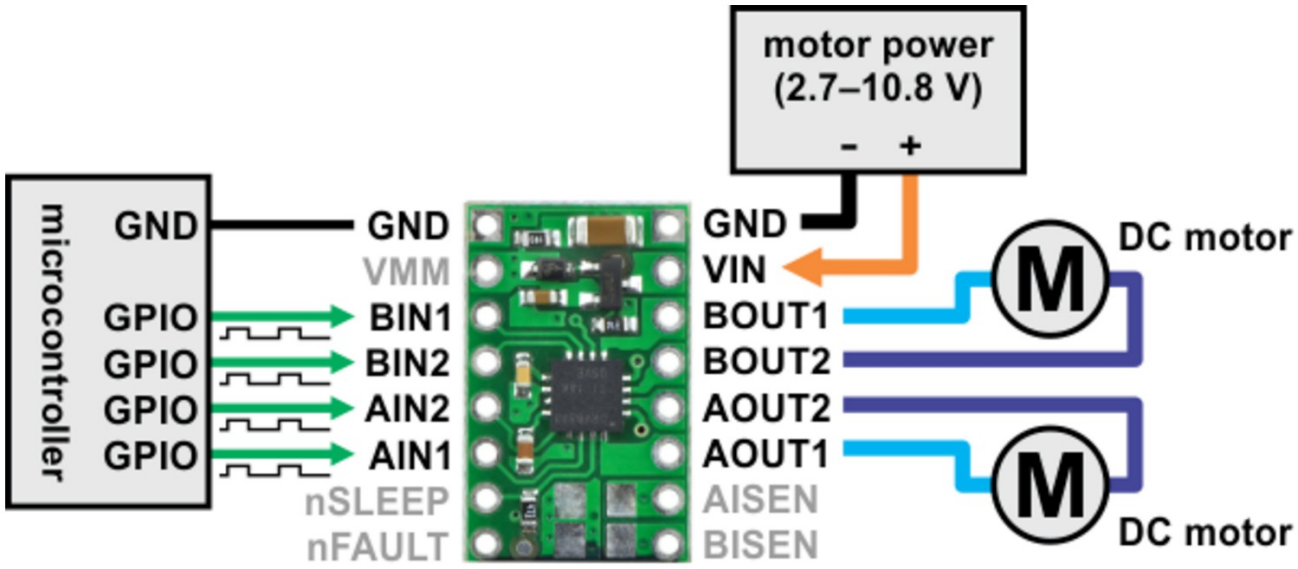


Figure Proj-3B. Vendors Basic Circuit for Driver.

LED CUBE

The objective of this project is to create a three-dimensional graphical display. These displays called LED cubes are best demonstrated by a video, the link to which is given below.

https://www.youtube.com/watch?v=yst4eL0-Eco

There is also a LED cube construction video, similar to the way we will be making ours.

http://www.instructables.com/id/4x4x4-LED-Cube-Arduino-Uno/?ALLSTEPS

https://www.youtube.com/watch?v=vf_IpviMiFU

Be aware that we will be programming ours differently, but the construction of the cube will be much the same. Now to that point the following is the circuit diagram for the circuit board that will be in the kit.

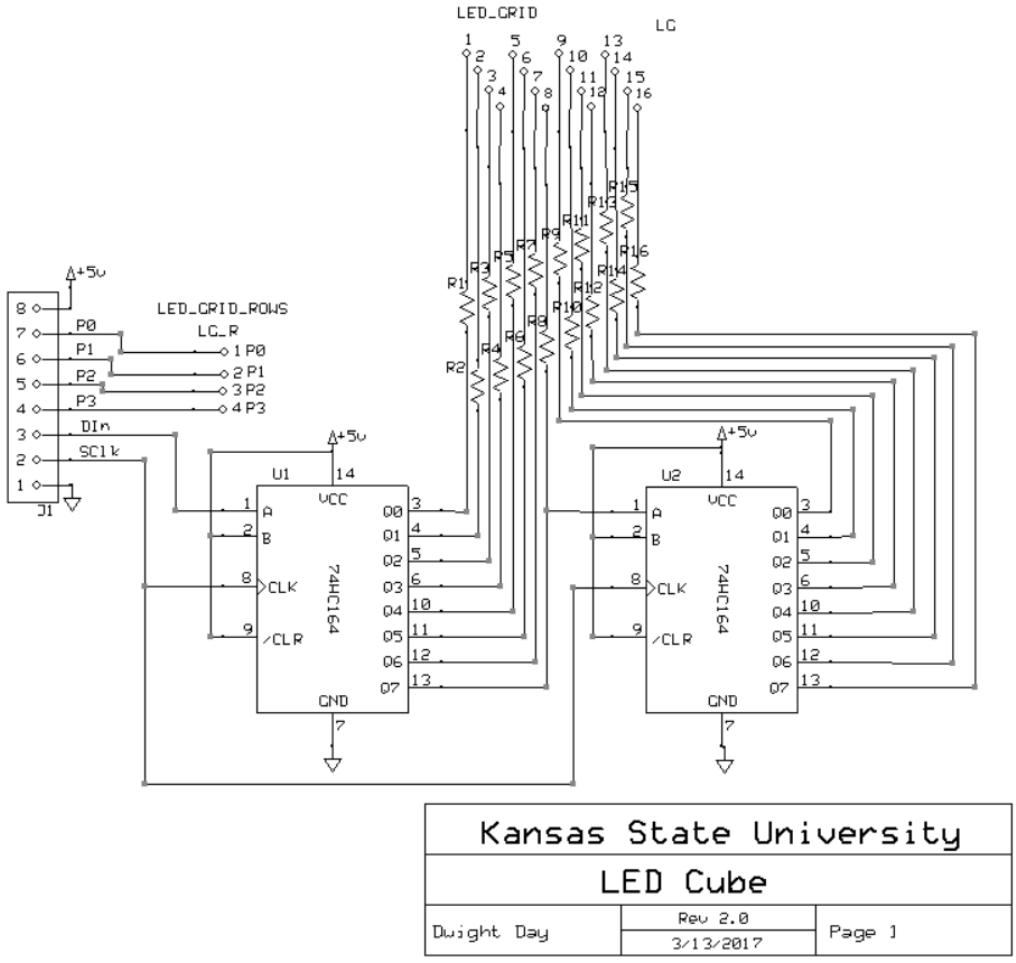


Figure Proj-4A. Driver Circuit for LED Cube PCB.

A complete description of this circuit and setup can be found under “Files->Course Notes->Hardware Documentation->E_LED_Interface.pdf”