Electrical Recruit Project: Brightness-Controllable Arduino LED Board

For SDSU Mechatronics

System Purpose

The system is a PCB that contains an ATMega328P-A microcontroller, a pushbutton, and an LED. The brightness of the LED can be switched on and off via the button, and have its brightness set to various levels through the Arduino serial monitor. It supports ignoring serial input when in the off state, 6 different brightness levels, and brightness readout when setting the brightness through entering letters into the serial monitor.

System Explanation

The brightness of the LED is switched on and off through a pushbutton that works by allowing a 5V signal to enter the Arduino digital pin 7. Pushing the button triggers a LOW or HIGH state, and by using the if statements in the first half of the Arduino code it will set the PWM pulse rate to 127 (half brightness) if it was at 0 (off state). If the value was ever higher than 0, it will reduce the brightness to 0 instead, turning it off.

The serial input is ignored when the switch is in the off state, done by applying a check for the last button state for each of the serial input if statements that control brightness levels. The last button state is changed in the first half of the code where it checks the current brightness, and if it is higher than 0 (indicating that it is on) it sets the state to off, and vice versa.

The 6 different brightness levels are done by using analongWrite() to change the pulse width of the incoming 5V signal, with higher values increasing brightness and lower values decreasing brightness. The bigger the value, the bigger the width of the 5V signal, and the higher the brightness. There are 6 if statements tied to a distinct character that, when entered into the serial monitor, sets the brightness to a certain level by using analogWrite().

Challenges Faced

Much of the challenge of this project was learning how to use KiCad, such as choosing components and placing them. This just took time for me to get accustomed to using the software. Another challenge was trying to route all the traces in the PCB editor without any colliding, which was averted by using two different PCB layers with two layers of traces, and for the surface mount chip I used vias to switch between layers to go under traces and to get to their pins without collision.

Conclusion

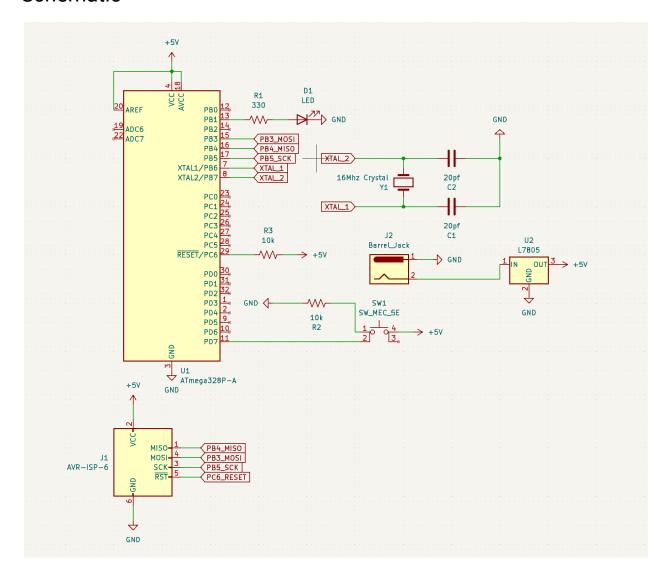
Overall, this was a very fun project that introduced me to the proper PCB design workflow, and also taught me many things about how circuits work such as the relationship between current, resistance, and voltage.

BOM

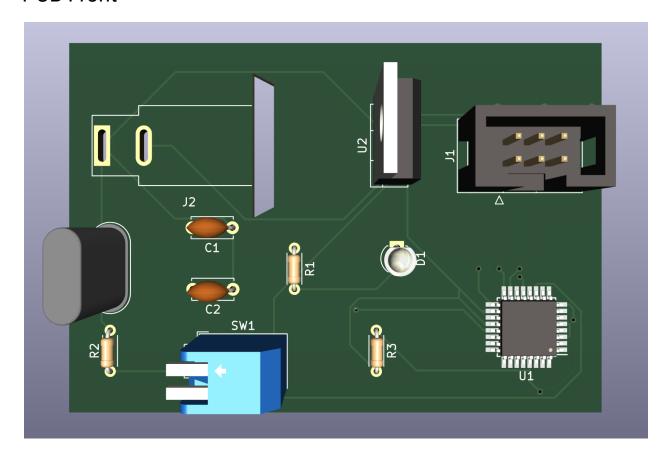
Parts	Quantity
20 pF Disc Ceramic Capacitor	2
Clear LED	1
AVR-ISP-6 Header	1
Barrel Jack	1
Resistor (330 ohms)	1
Resistor (10k ohms)	2
SPST Piano Button Switch	1
ATmega328P-A Package Microcontroller	1
LM7805 5V Regulator	1
HC49-US 16Mhz Crystal	1

Total price for an equivalent of 8 GoBilda kits was \$1,599.92.

Schematic



PCB Front



PCB Back

