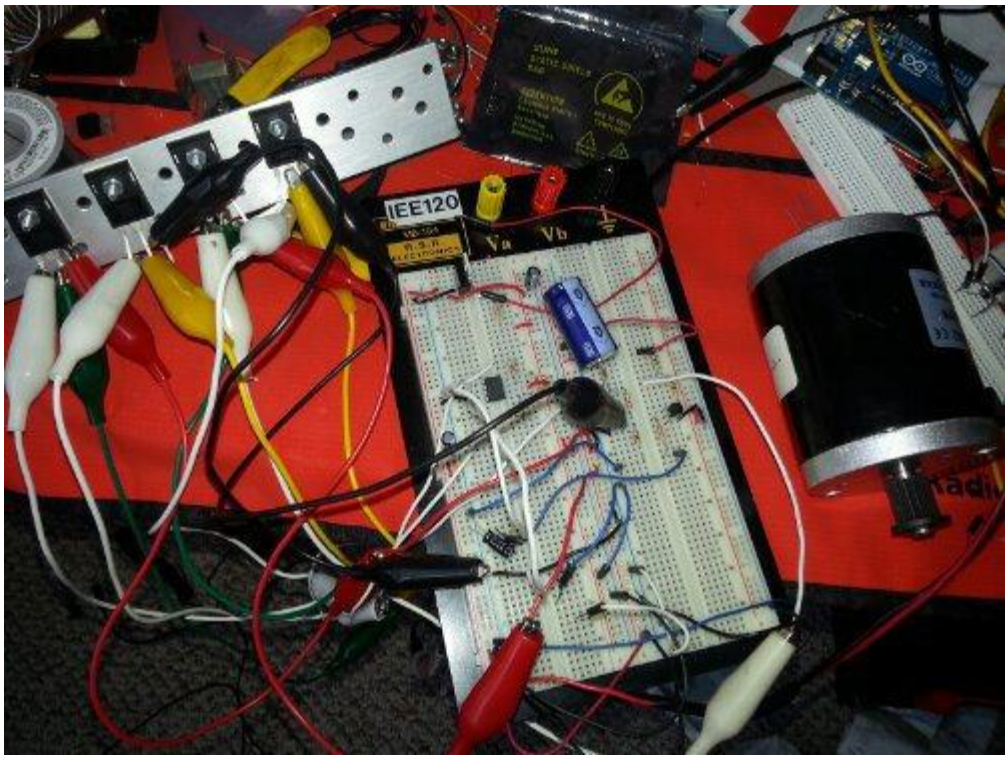
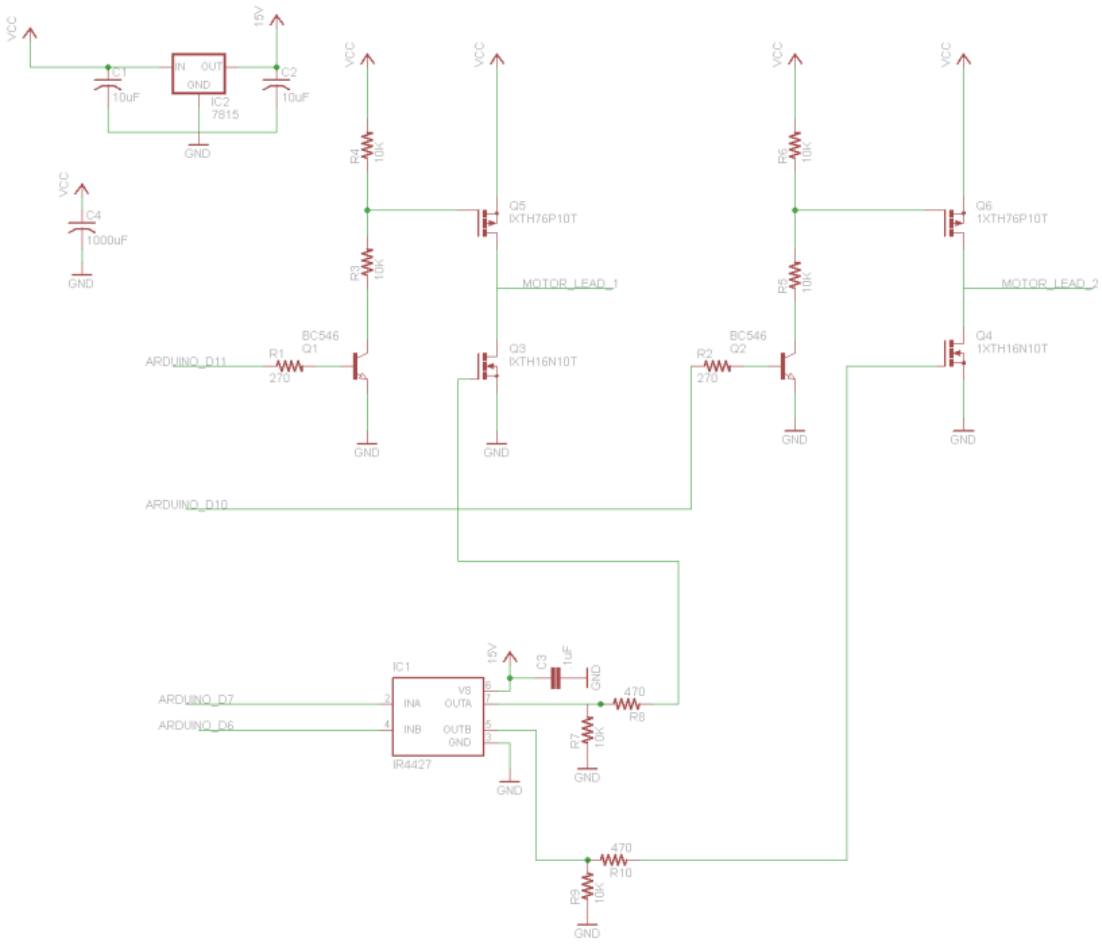
Arduino 24V Brushed DC Motor Controller Shield Update #3



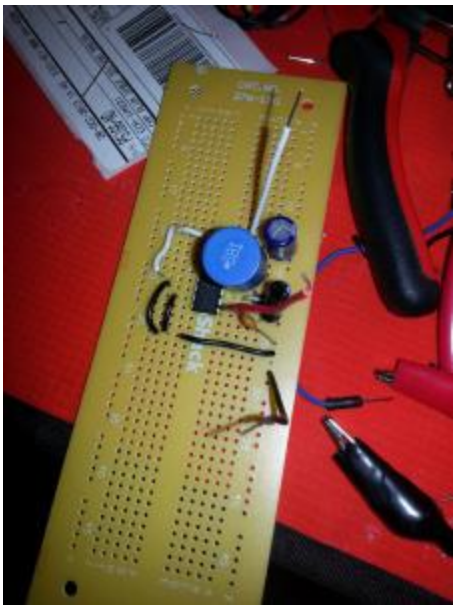
Hey guys! Today's post will be a relatively short post compared to the last post, but I just wanted to update you guys on my project. Well, the first thing I want to mention is that I finally tested the circuit with the new Arduino, and it works perfectly! No short circuits, and the motor rotates properly. I included a picture of the schematic in the figure below. If you're having a hard time viewing the picture, just click on it and it will expand.



So does that mean my project is finished? Nope. In fact, this project is just getting started. I want to make some serious improvements to this circuit. First obvious improvement is by making the circuit as cheap as possible. For example, the MOSFETs I used for the circuit are really nice and robust (they're rated around 150V/100A), but they cost $24 in total. Second, I must include an overcurrent protection circuit as it will prevent the MOSFETs from getting damaged when the motor is stalled. The next improvement is the inclusion of a undervoltage and overvoltage lockout to protect the Arduino from any possible damage. Not to mention, by adding overvoltage and undervoltage lockout circuity, I can forget adding an isolated DC-DC converter, which are really expensive. Finally, I will consider the project fully complete once I implement the circuit on an Arduino shield.

There's another thing I want to look into. When I was running the motor control circuit with the motor attached, I noticed that my power supply went into current limit whenever I commanded the motor to make a sudden turn. This is due to the large amount of power needed to apply a torque large enough to change the rotation of the motor's shaft. However, this solution can easily be fixed by implementing motor soft

start code on the Arduino, which involves applying an increasing.decreasing PWM signal to the gate of the upper transistors to limit the power following through the motor.



Well, this is a first. This is kind of an embarassing first, but a first nevertheless. In my two years blogging on Cool Cap Engineer, I could never get past a third update for any of my projects. A lot of the times, I cancelled a project due to the huge time commitment for a project, or the lack of knowledge on the project's topic. With that said: here's the 4th update for the 24V Brushed DC Motor Controller Shield project.

In my last post, I mentioned that the original 24V Brushed Motor Controller circuit needed some improving. One of the crucial improvements I mentioned was adding overvoltage and undervoltage protection circuitry. Because of the power supply protection circuitry additions, I decided to look into the LM2574: a 12V/.5A Buck Regulator IC. By using the LM2574, not only will I be able to add the protection circuitry by manipulating the on/off pin of the regulator, but its surprisingly more efficient than the 7815 linear regulator I was using.I could not emphasize how efficient this regulator is. No matter how much I loaded the regulator, it still delivered 11.92V to the load. Even when I loaded the regulator with a 24 ohm resistor, it still maintained 11.92V. Of course, the performance will change depending on huge temperature variations, but I'm assuming the final shield will be used at room temperature.

Just for the sake of curiosity, I wanted to see how the regulator performed when I loaded it with an Arduino, which typically draws 30-40ma. To my surprise I regulator delivered 11.97V to the Arduino. So I think I will use the LM2517 in the final design.

The final thing I was thinking doing for the project was implementing the MC33035 brushless motor controller on the shield. The MC33035 can not only control DC motors, but it comes with a current limit. If I have time this week, I will implement the undervoltage and overvoltage protection circuitry with the 12V Buck regulator circuit and start working on the PCB for the shield, which will control 1 motor. Once I test the shield, I will modify the shield to control 2 motors.

Source: http://coolcapengineer.wordpress.com/2013/12/16/projects-arduino-24v-brushed-dc-motor-controller-shield-update-3/