

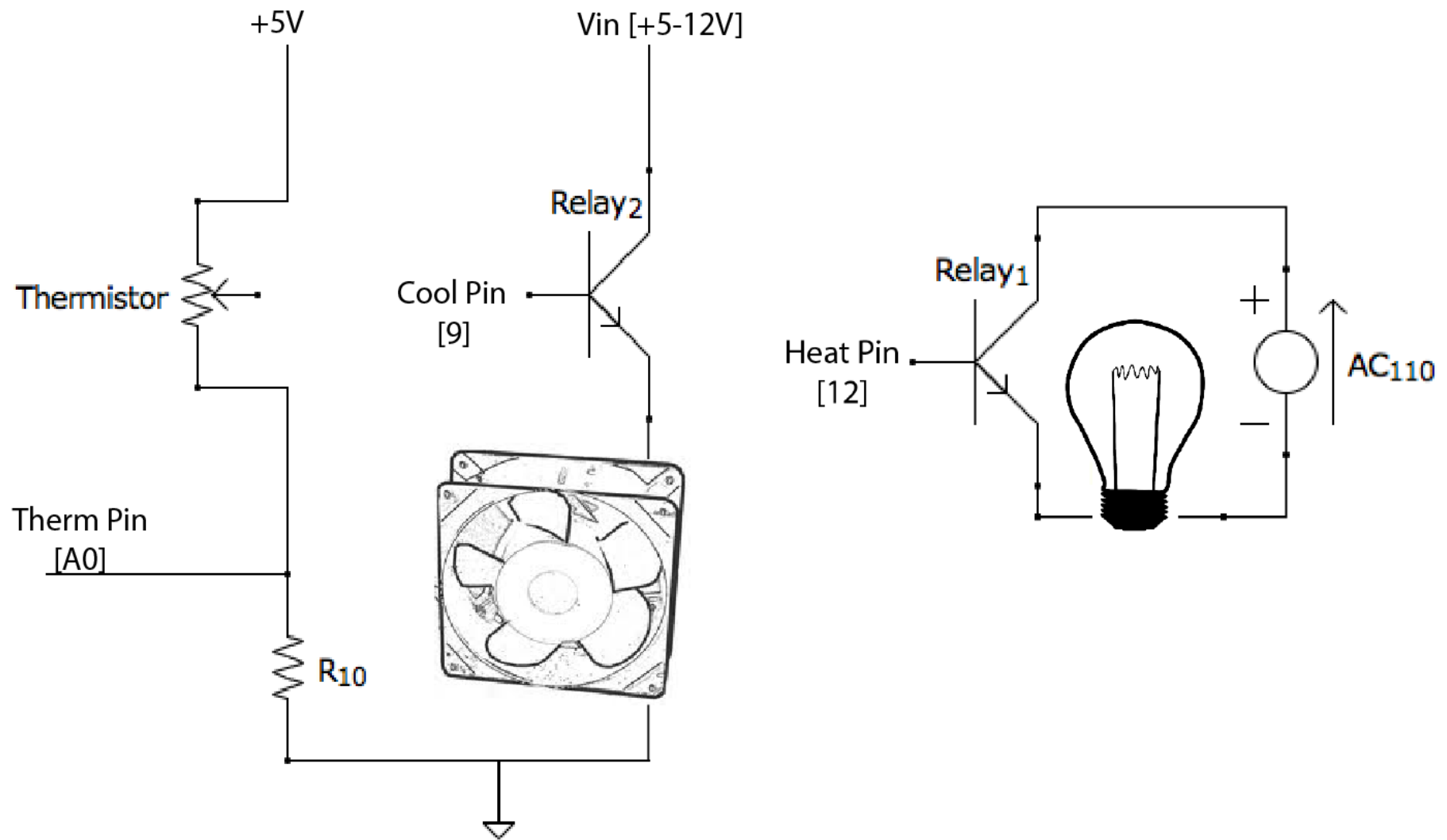


The Light Bulb PCR Machine

Based on this 'manual' PCR machine I built a few weeks ago, the Light Bulb PCR machine uses a light bulb and an old computer fan as its heating and cooling elements:

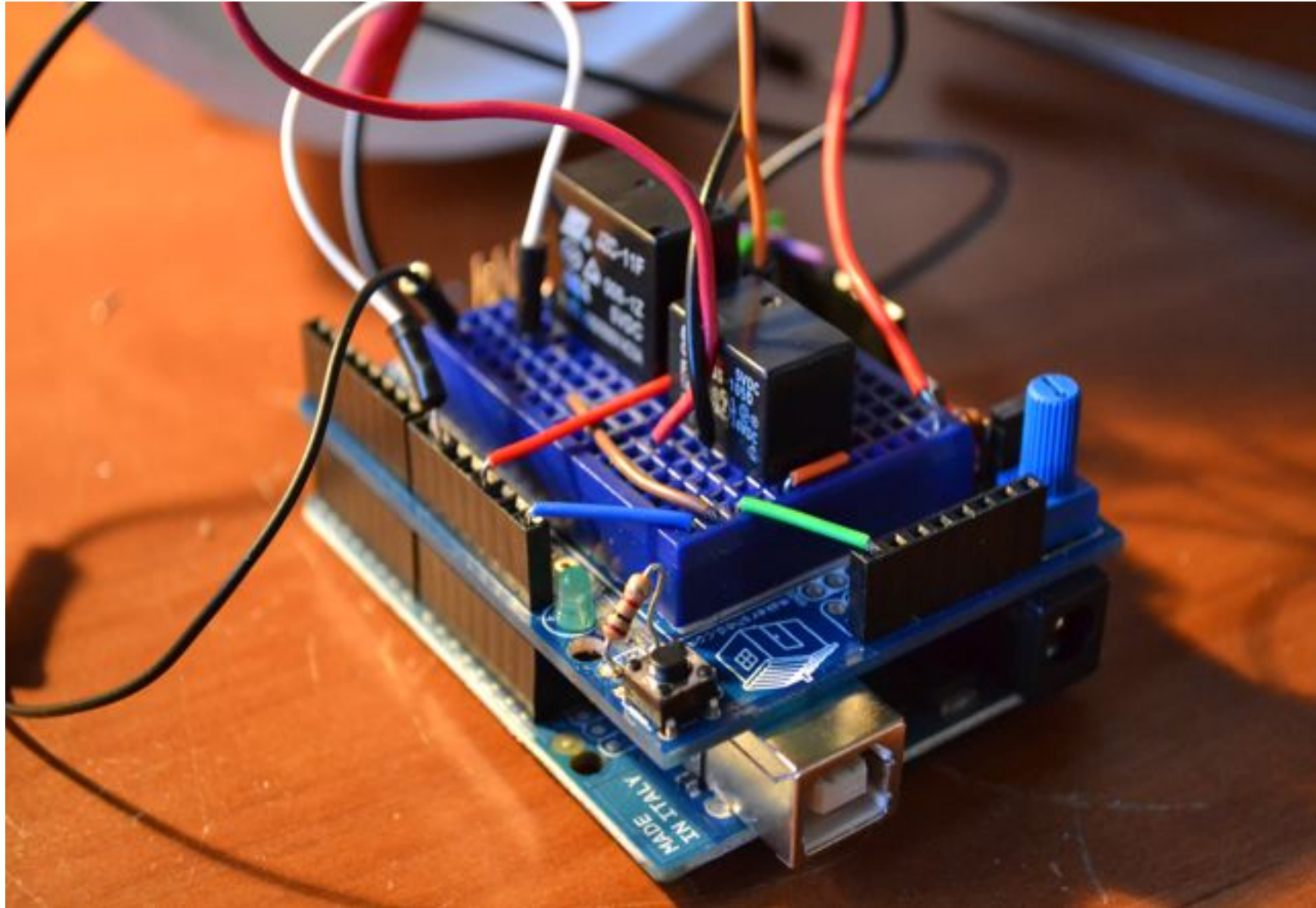


Instead of the switches pictured above, the unit is now controlled by an Arduino Uno, [Code Available Here](#). It uses a thermistor (a resistor that allows more current to flow the more heat is available) to monitor the temperature of the samples. Here's the schematic:



The light bulb is run on 110 Volt AC, so the Arduino controls a relay which turns the lamp circuit on and off. Both the Arduino and Fan can be powered by USB or by a 12 V external power supply (which provides

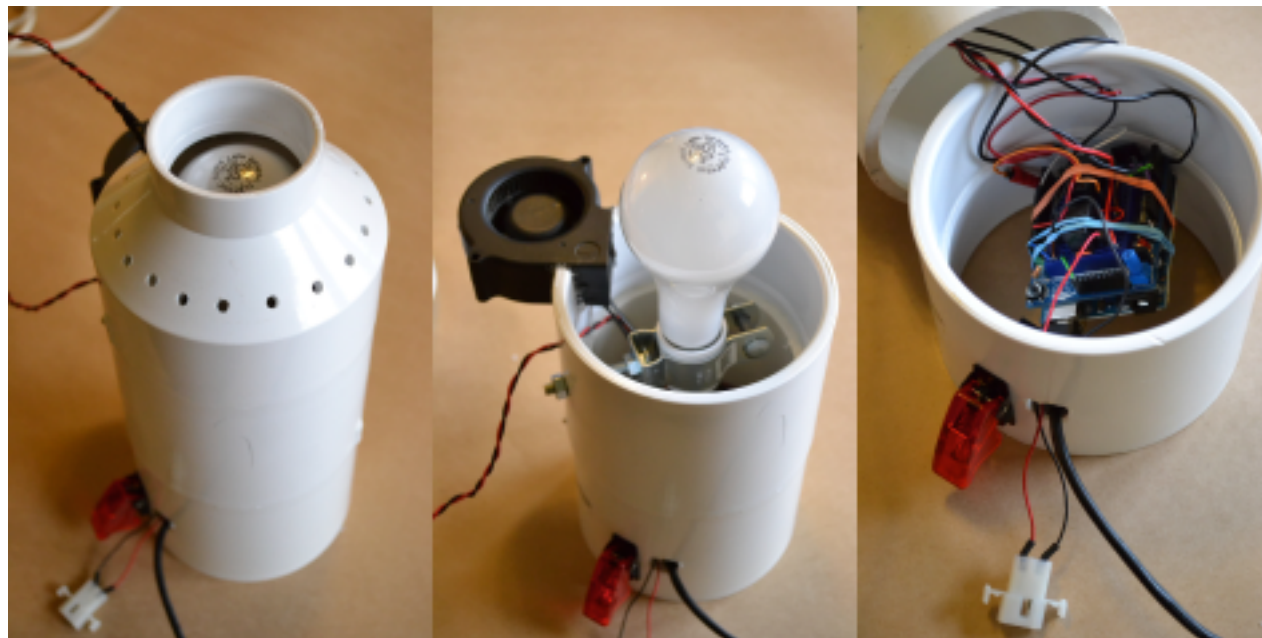
faster cooling rates). I was able to put both of the relay systems onto the Maker Shield (which is awesome by the way, if you arduino you should look into getting one). This is what it ended up looking like:



In this model, the tubes are heated using a 150 Watt light bulb (though you could definitely go with lower wattage) and cooled simply by an old computer fan I had lying around from one of many PC cannibalizations. The timing of the machine is actually pretty solid - a 1 minute elongation with 25 cycles ends up being ~2.25 hours. I'll get ramp rates posted soon.

I built this prototype out of 4" PVC pipe for a few reasons: because there are many prefabricated attachments available, it's easily available and has consistent diameter and because I have quite a bit of experience working with it.

There are three layers in the system all based on one 4" PVC coupling and held together with regular 4" pipe. The top layer is concave and holds the tubes and thermistor near the light bulb. The middle layer holds the fan and light bulb in place. The bottom layer encases the control system and safety switch in case something starts to smell....smoky.



The temperature is monitored using a thermistor - basically a resistor that decreases resistance the hotter it

gets. The way I have it wired, the hotter the thermistor gets, the more potential feeds into the analog input pin on the arduino. The thermistor is placed inside one of the tube holes on the top unit.



There are more accurate devices available (such as the IC temperature sensor LM355 and pals) which I will use in successors to this prototype.

I still run the machine using my laptop and the arduino serial monitor, but it can work as a standalone device if you don't want to monitor the cycles. The arduino can be powered from the USB port while the lamp circuit needs to be plugged in to a 110 outlet.

[Light Bulb PCR](#) from [Russell Durrett](#) via [Vimeo](#).

If you have any suggestions or questions, feel free to post a comment through [my blog post](#) or email me directly: russell (at) durrett.org

[Home](#)

Written January 6th, 2011 by Russell Durrett