

Arduino Controlled Relay Box

by [natantus](#) on October 31, 2009

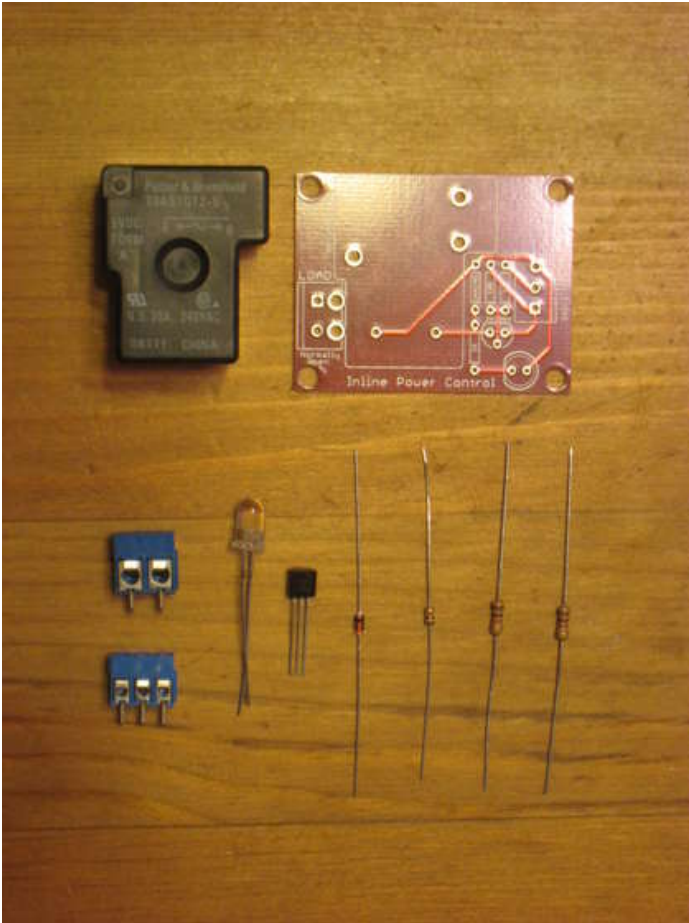
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Intro: Arduino Controlled Relay Box

This project is designed to help you construct some relay boxes for controlling power from your wall socket using an arduino or microcontroller. The inspiration for writing an instructable came when I decided to build some relay boxes for my personal Garduino project. For safety concerns I started designing my own relay circuit and outlet until I came across SparkFun's article "[Controlling Big, Mean Devices](#)".

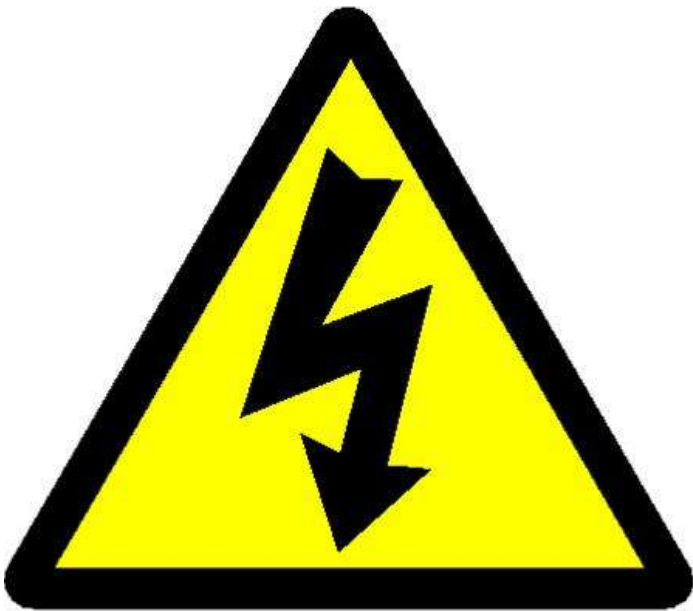
I decided to abandon my own plans mainly due to time and cost and ordered the parts from SparkFun. What follows is essentially the same information you'll find on their guide but with a few of my own notes. I hope that you find my insights helpful and it will get your project off the ground without a hitch.



step 1: Parts and Safety

The great thing about this project is that there aren't a lot of parts that you need to get started. You probably have most of the parts lying around your junk box and the rest you can order directly from SparkFun or your favorite supplier. I've made a list of parts available on my wiki. SparkFun can supply the relay and PCB and your local hardware store will have your GFCI Outlet and electrical housing.

Now a brief note about safety. Every time you work with electrical lines you may be risking your life if you don't use the right precautions. In general you should always employ a certified electrician but you can do this project on your own if you're careful. Absolutely ensure the plug is not connected to a live electrical socket when working on the relay, the outlet, or the extension cord at any point. Also, it's probably good practice to enclose any wires before testing. With that you should probably do just fine.



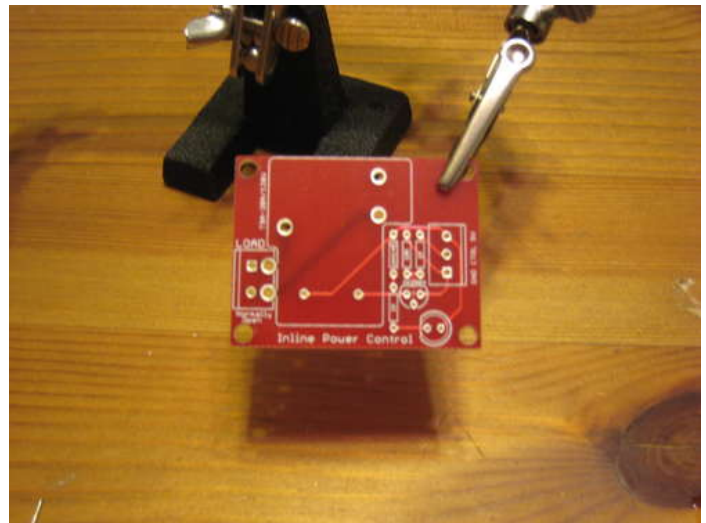
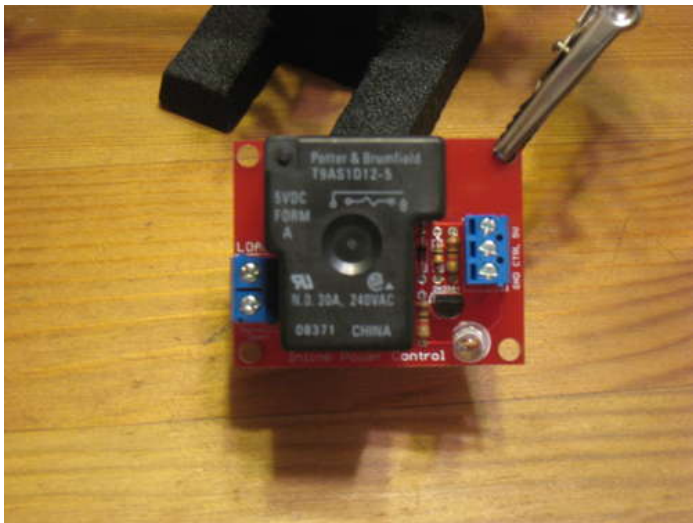
step 2: Assemble the circuit

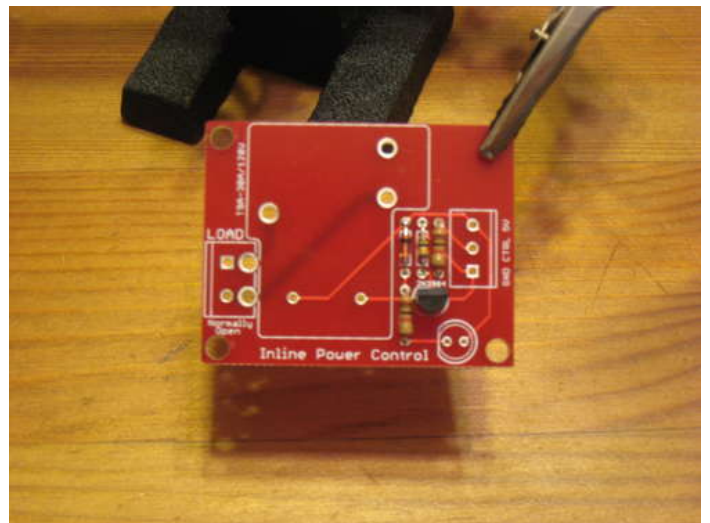
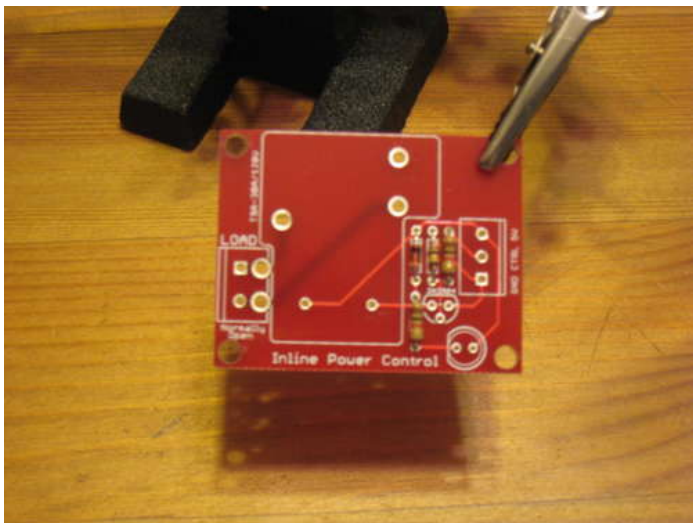
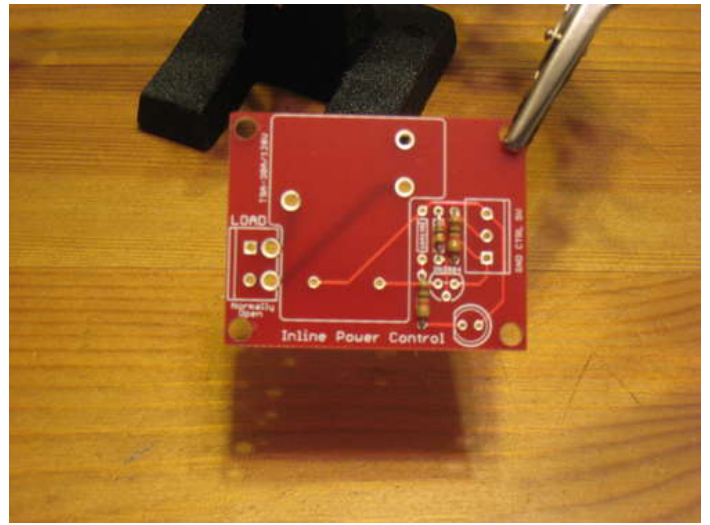
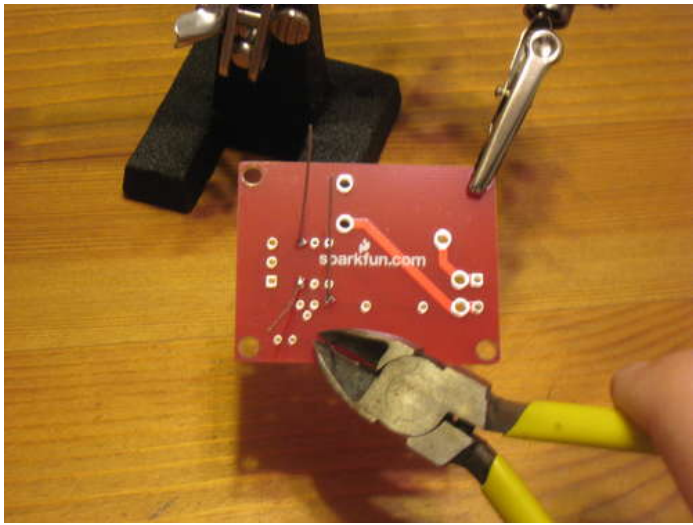
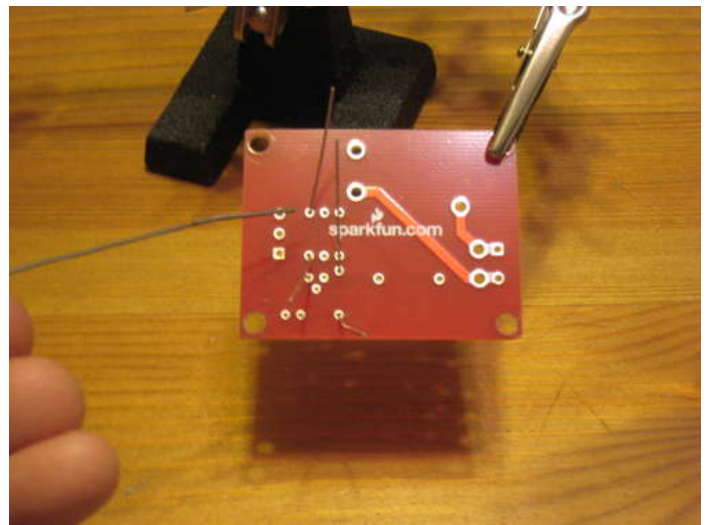
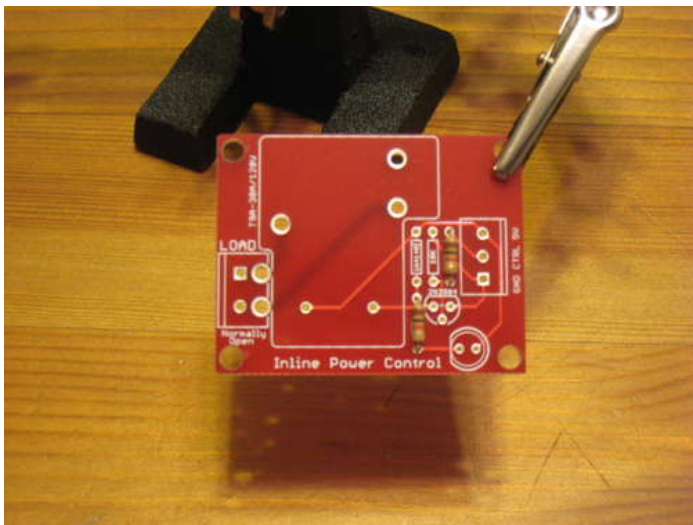
Assembling the circuit only takes a few steps. I've included pictures of them below and a list of how I built things, which was based upon the height of all the parts.

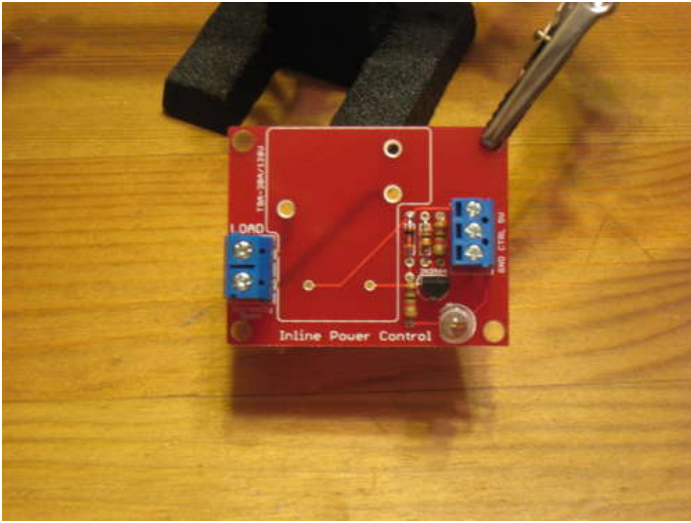
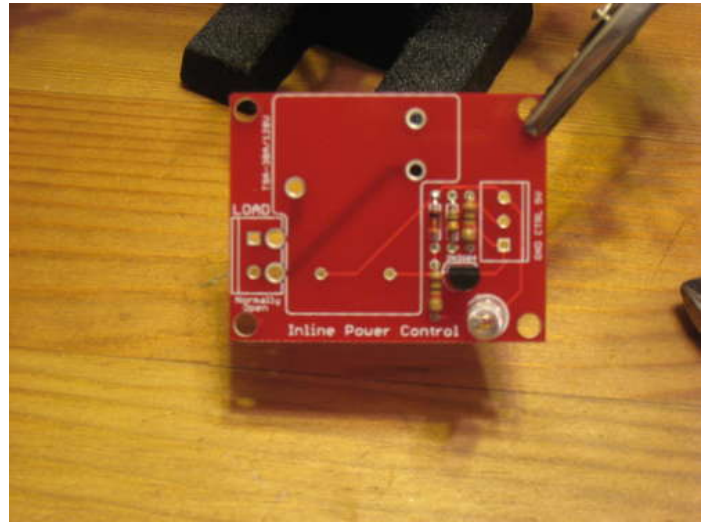
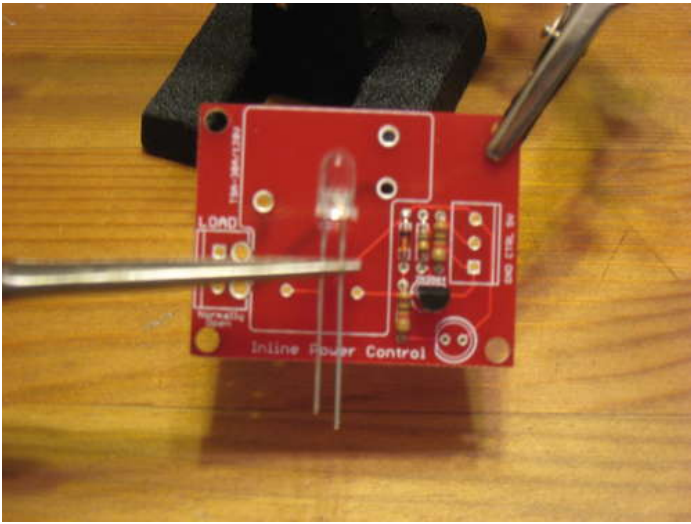
1. Attach the resistors
2. Attach the diode
3. Attach the transistor
4. Attach the three pin screw terminal
5. Attach the two pin screw terminal
6. Attach the LED
7. Attach the Relay

What I learned while doing this is that it's useful to use the stand to do the smaller parts. When you get to the screw terminals use the table to help you get them on straight. It's difficult to put on the terminals with the LED on the board because it's the tallest component aside from the relay.

Put the relay on last because it gets in the way if you don't. You will find it to be a little tight against the two pin screw terminal, but that is ok because it still fits. You don't have to use the two pin screw terminal either and can opt to solder the extension cord directly to the board, but I decided against that for usability.







step 3: Splicing the Wires

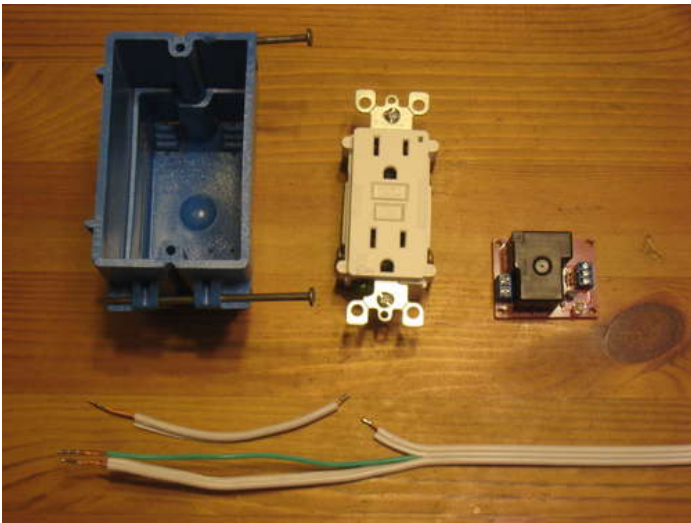
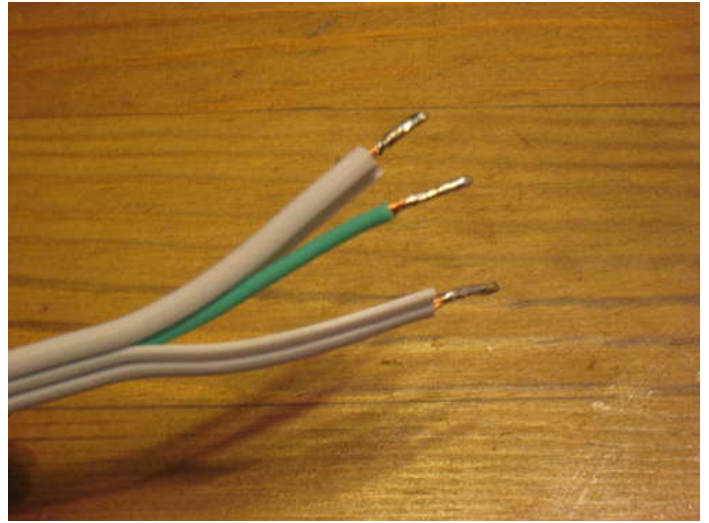
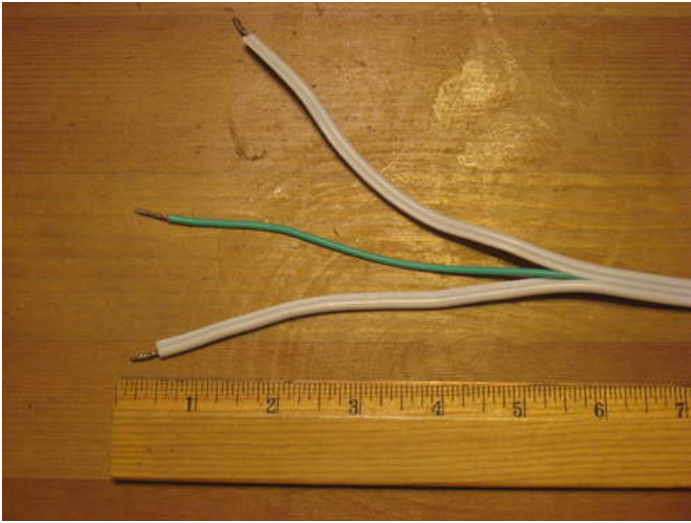
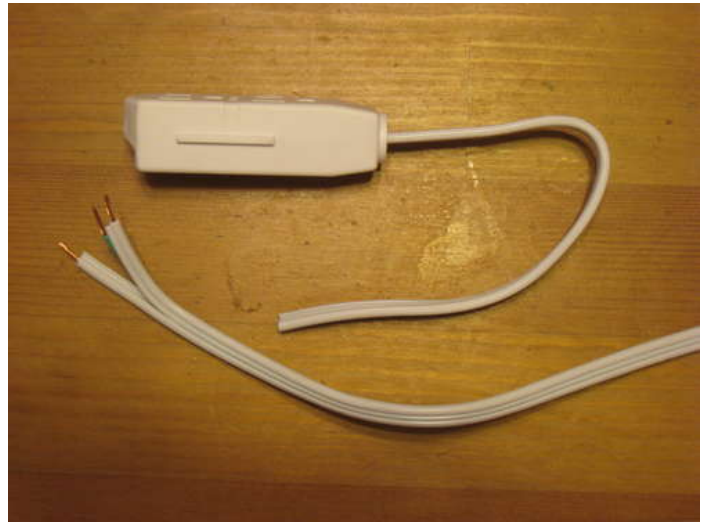
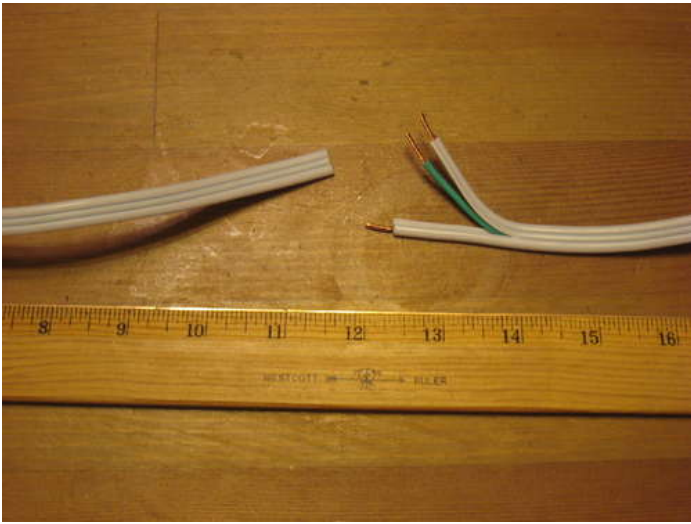
When you splice the extension cord wires you are likely to see one of two things. Either your cord has three different color wires or it doesn't, but there ought to be three or this project won't work. The three cords are as follows:

- Green - Ground Return
- Black - Hot Wire
- White - Neutral Wire

If your extension cord does not have three wires then you'll have a green wire in the middle, one smooth wire on one side which carries the voltage (The Black Wire), and one wire with ridges on the other side (The White Wire). Double check these before you make any live electrical connections. Even I messed this up and caught it just in time.

You're going to cut the extension cord about a foot from the end of the female plug. Then split the three wires about 6 inches down. Cut the black wire five inches from the end. This should give you about one inch attached to the cord and a 5 inch extension that will go from your relay board to the outlet.

Next strip and tin the end of all the wires. It's likely your wires are a collection of smaller wires, twisting them before tinning is a big help. Then lay out everything and check it before moving on.



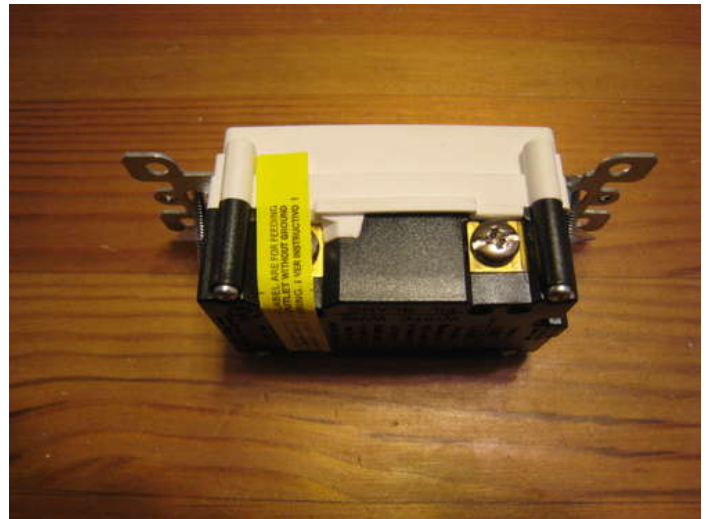
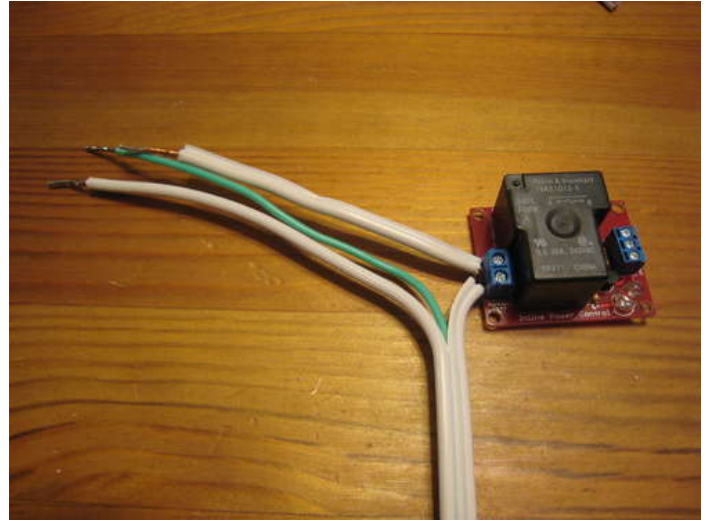
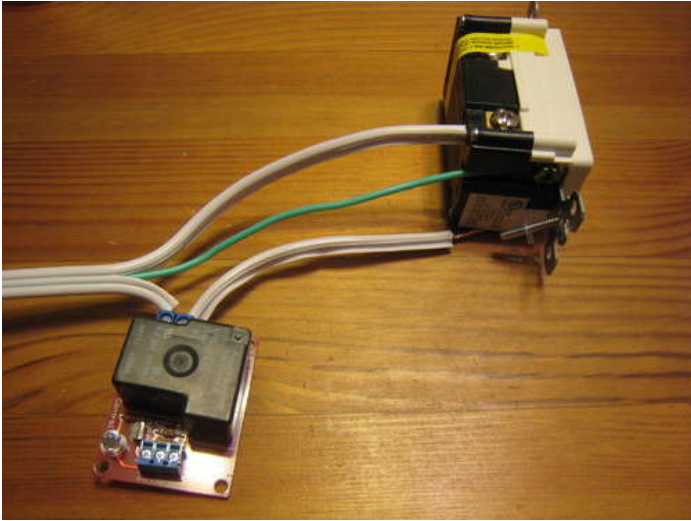
step 4: Assemble the Relay and Outlet

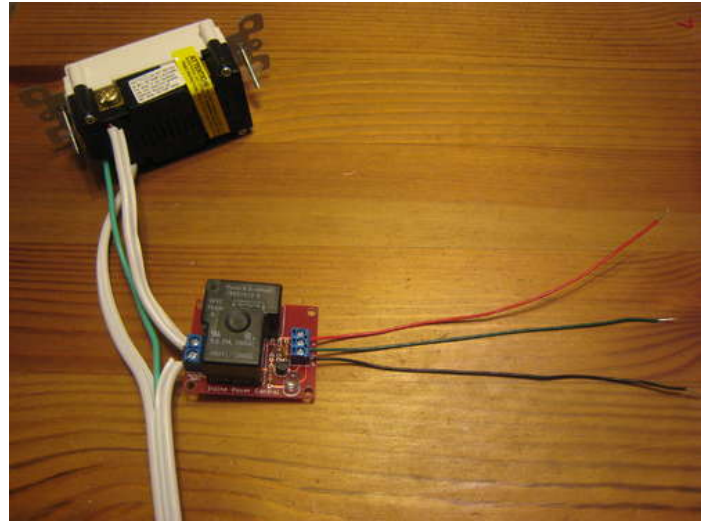
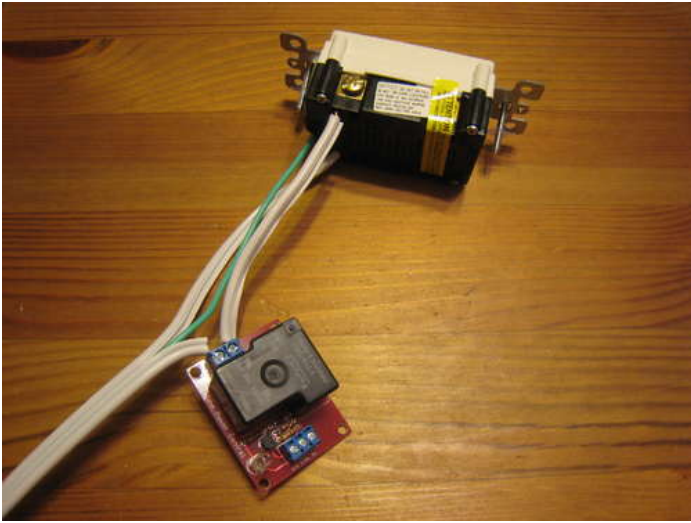
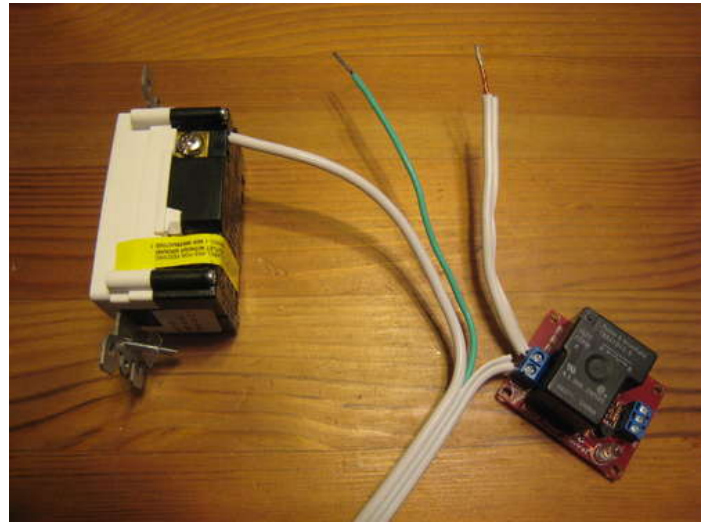
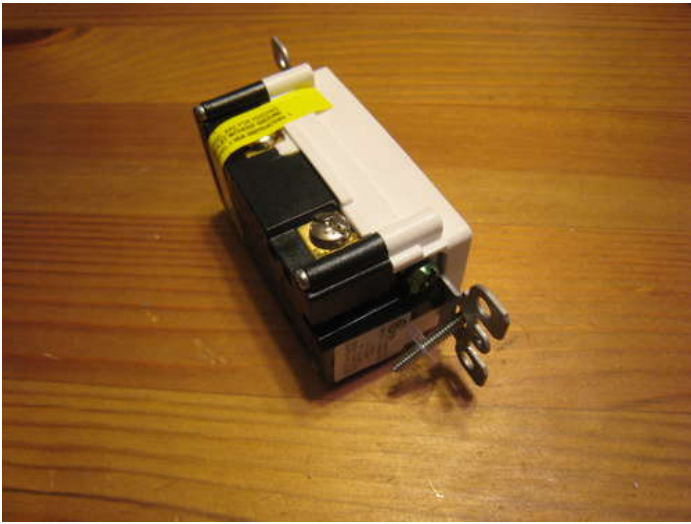
You're almost there! You need to attach the relay and the outlet to the extension cord you just prepared. Something to remember here is to thread the extension cord through the nail mount housing before you attach it to the relay and the plug. This is especially important if you intend to solder the hot wire to the relay board. Remember, I decided against this in case I wanted to re-use the relays at a later time and instead used the screw terminals.

The GFCI outlet is the most important part of this entire apparatus. The reason you're using this instead of a different outlet is that it may protect your life in the case of an over-voltage event. For this reason I recommend that you actually take the time to read the manual that came with your outlet before connecting the wires.

I was fortunate that my outlet had color coded screw terminals on it. On mine the ground plug screw was green (for ground), the hot wire attached to the brass screw, and the neutral wire to the silver screw. Also, my wires connected through holes in the back of my outlet plug, not the exterior. I can't help you with your outlet, so again read the instructions.

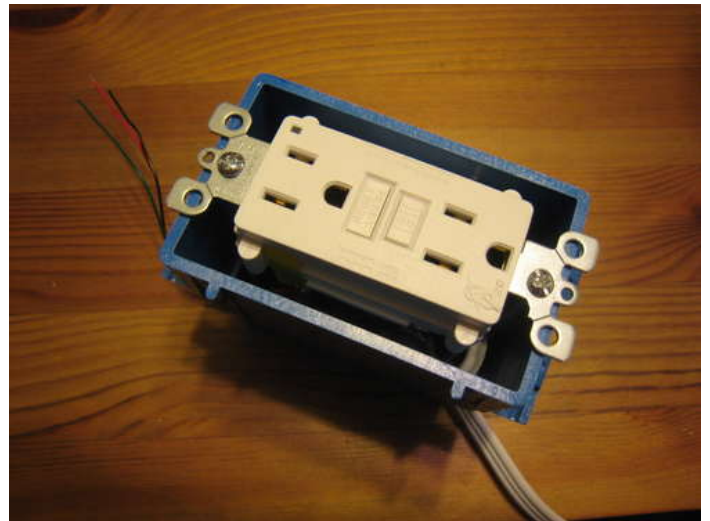
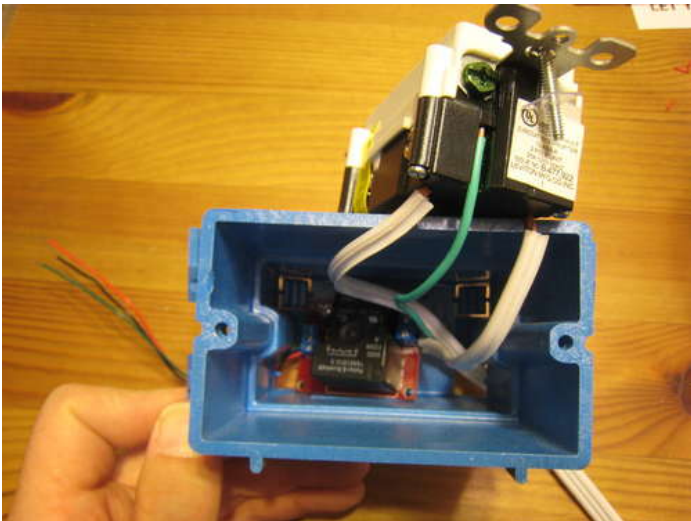
Finally, cut three six inch pieces of 22-gauge wire. I chose three different colors so I could distinguish them when hooking them up to my microcontroller. I suggest you do the same thing. Also, don't get them backward. I made two of these and accidentally hooked up the ground and +5V lines in the opposite position. It didn't hurt anything but I had to take the whole thing apart just to reconnect the lines properly.

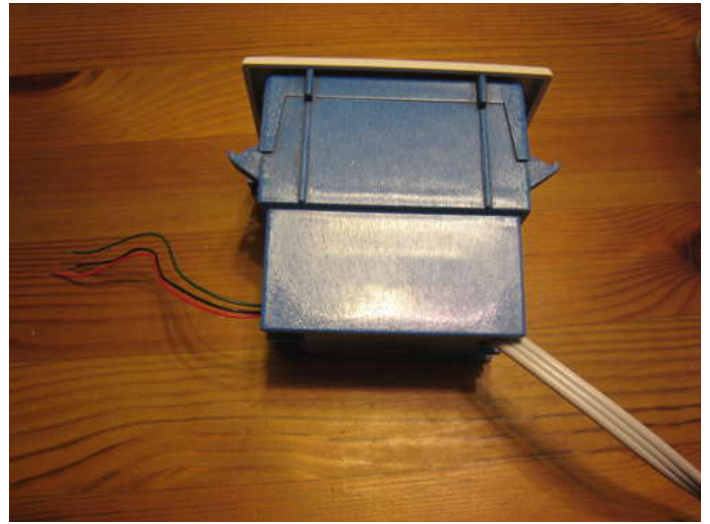




step 5: Complete the outlet box

Now you've got everything connected all you have to do is close up the box. Since you already threaded the extension cord you should be able to simply pull everything into the housing. Pull the control wires out the other side of the box and push the relay board to the bottom. Put the outlet on the top and screw it in, finishing with the top plate. If you have stickers that say "GFCI Outlet" you can put them on the sides of the box at now and move on to testing.





step 6: Test with an Arduino

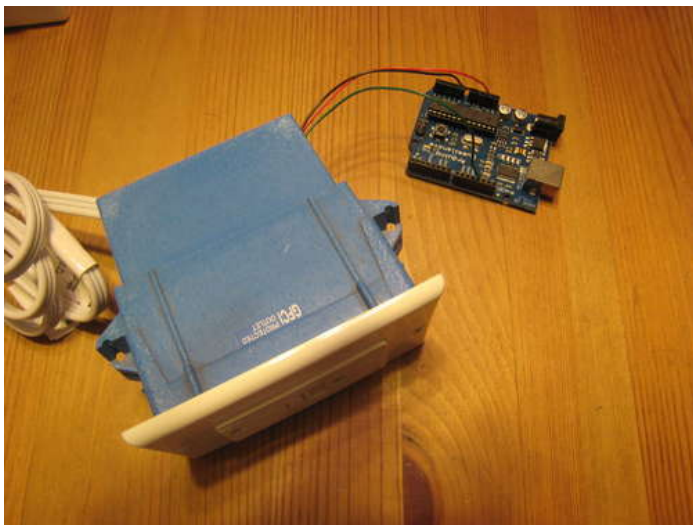
You are now done with your project. If you've wired everything up then you're ready to test out the box. I tested mine with my arduino. Below is some code you can use to test yours out too. In this case I connected up the red wire to +5V, the black to ground, and the green to digital pin 12.

Here's the code I used:

```
{}  
//--- Digital Pins  
int ledPin = 13;  
int relayPin = 12;  
  
void setup(){  
  //--- Set up the LEDs as outputs  
  pinMode(ledPin, OUTPUT);  
  pinMode(relayPin, OUTPUT);  
  
  //--- open the serial port  
  Serial.begin(9600);  
}  
  
void loop(){  
  
  digitalWrite(ledPin, HIGH); // set the LED pin High  
  digitalWrite(relayPin, HIGH); // set the relay pin High  
  delay(10000); // wait for a second  
  digitalWrite(ledPin, LOW); // set the LED pin High  
  digitalWrite(relayPin, LOW); // set the relay pin High  
  delay(2500); // wait for a second  
  
}  
}}
```

Next I plugged in the extension cord and plugged a lamp into my new box. I uploaded my code, ran the program, and watched the lamp turn on and off. If you've done it right you'll hear a loud click noise when the relay is tripped on or off and the LED will light up inside the box. If your light doesn't turn on then you may have to hit the "RESET" button on the outlet. When the outlet is on you may also see an LED turn on on the outside of your outlet.

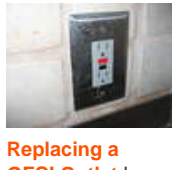
I hope this project worked for you. You'll find this useful in a number of great projects, so go out and make something fun!



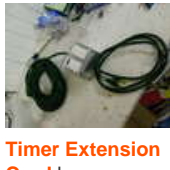
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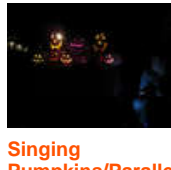
Replacing a GFCI Outlet by mje



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A USB Power Controlled Plug Strip. With Isolation. by toymotorhead



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