



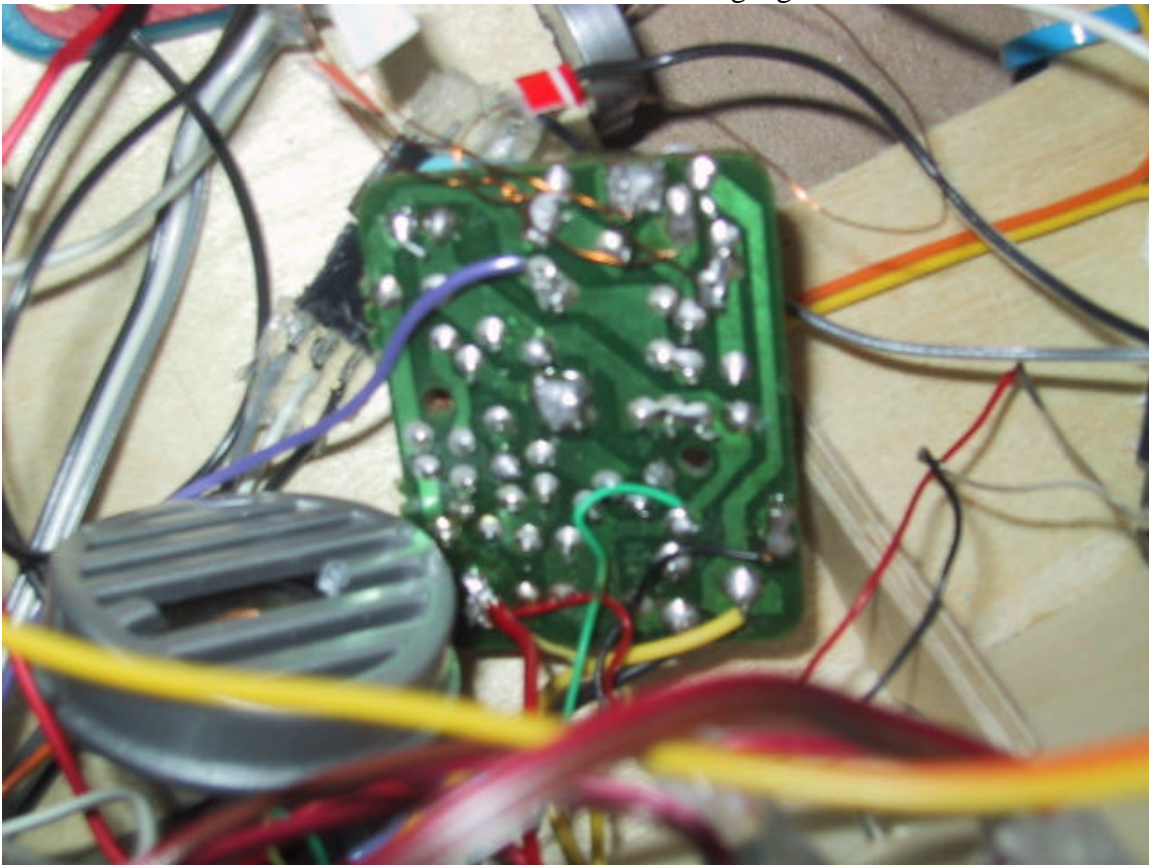
metal detector out-of-the-box

My special sensor is a metal detector circuit. The circuit is a metal detector toy from the Discovery Channel store in Schaumburg, Illinois. The toy costs \$10 and has since been discontinued. Luckily I was able to purchase a second detector before they left the shelves in Schaumburg. I was worried about the IR sensors throwing off the metal detector readings, but during testing I noticed no effect with both systems running at the same time. I initially tested the detector as it was out of the box. It was able to detect all the coins within a close proximity (1-2cm away) without being thrown off by large metal objects far away. After disassembling the detector I began to search for a signal to send to the microcontroller.

I initially was going to use the pulses sent to the detector's speaker to trigger the coin-fetching behavior. After analyzing the signal on the oscilloscope I found the pulses to be about 4ms apart when metal was under the coil. Writing software for this signal would be cumbersome. I would have to use the HC11's input capture system to count the clock cycles between speaker pulses. If the duration between pulses were short enough the coin-fetching behavior would be called.

Upon further analysis of the metal detector's circuitry I found an analog signal, which ranged from 0.6V to 2.5V (30 to 128 for sensor reading) when metal was under the coil. Finding such a signal was a great relief. I immediately tested the signal on the oscilloscope and found it to be a smooth dc voltage. I decided to use this signal to elicit the coin-fetching behavior.

The metal detector was originally a handheld toy powered by a 9V battery. After discarding the non-functional parts, I mounted the coil and sensitivity potentiometer. I decided to power the sensor with a 9V battery rather than running it off of the robot's main battery pack. In order to do this I needed to make a common ground between the 2 sources. I soldered a wire between the negative terminals of both batteries to do this. I then soldered a wire to the location I had found the analog signal on the circuit earlier.



Close up view of the metal detector, and analog signal wire (purple wire)