Signal in the noise

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Roomba 4230 Optical Encoders

A few weeks ago I saw an advertisement on Craigslist for a Roomba that "needed batteries" for the low low price of $15. Having $15 in my pocket and having recently discovered a few blog entries on about how ridiculously easy the roomba robots were to hack, I could not resist.

Unfortunately as I brought the unit home, I recognized the smell of fried circuitry, and sure enough taking a peek inside the unit confirmed that it had a near death experience with some kind of voltage surge that left a good char on the motherboard. It would need alot more than a new battery.

In the back of my mind, I had already done the math on finding two decent DC geared drive motors, and figured $15 was not a shabby price for the roomba even if it was completely dead. So, I channelled my inner five year old,

and began disassembling.

I quickly found that the iRobot company loves screws, and that the roomba model that I had (4230), was very lovingly assembled. To my surprise, the unit reminded me of the lab robots I saw during my college days. Sensors had very nice connectors, and the wires were lovingly routed inside the robot case. It was very easy to break down and remove parts for re-use! I found 4 IR distance sensors in the front bumper, and two more IR sensors in the case that handled the infrared remote, as well as docking process.

I also found three little switches, a speaker, and ofcourse, the object of my mission, the geared DC motors. As an added Bonus, the motors had optical encoders attached. That bumped the value up significantly. its hard to find a geared DC motor with attached encoders for under $30. So... Major +**1** for buying a used Roomba off craigslist!

Unfortunately, given the nasty black char on the motherboard, I was not entirely sure that the electronics would still work, but thankfully the sensors and motors passed my initial breadboard tests.

This was the point where I hit a slight snag, and decided my findings were worth a blog entry. Either my google skills are awful, or there is really very little information

on the optical encoders attached to the drive motors. Jason Dorweiller had a great entry on using these optical encoders, and he even made a nifty balancing robot with them, but he neglected to note how the wires mapped to the Encoder. Most roomba hacking entries concern using the Serial interface that is provided, and not harvesting the roomba for its electronics goodness.

I spent a little bit of time trying to figure out which of the motor wires were for the IR and which were for the detector. It was obvious that the Red and orange twisted pair were for Motor Power, and that left two twisted pairs brown/blue and black/grey. Taking the motor apart to have a closer look at the encoder did not help. Both the IR and the detector looked identical to me.

After a bit of cleaning, I decided to start experimenting. There were only two pairs of wires to consider, one was going to have to be the detector, so I started with a simple circuit that kept a 100 ohm resistor in place to protect the IR from burning out in case i randomly hit it. After a few failed attempts I found my color code for the Roomba 4230 optical encoders to be:

Blue = IR Anode orange/brown = IR Cathode
Black = Emitter

Gray = Detector

With those wires determined, it was easy enough to wire up a quick circuit for the arduino to test it. (In case your colors are different, the wires that are in the plate that detaches as you open the wheel assembly were my IR Anode and Cathode)

Ignore the little encoder picture and assume those four wires are going into your Roomba wheel with the wire colors as shown.

I used a 100ohm, and 10k ohm resistor (lower resistor in picture is the 100ohm, upper is 10k.)

I then ran a quick sketch to see the happy encoder ticks, started spinning my wheel manually, and there they were...

Get the Arduino code here

Hope that helps anyone in the same boat with their 4230

Roomba optical encoders... The motor itself is a 12V DC motor, and you would need an h-bridge and separate power supply to drive it. I would recommend the seedstudio motor shield, since currently it can be had for $14 at radio shack and does a nifty job of giving you nice connectors for your sensor wires as well.

Happy Hacking!

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