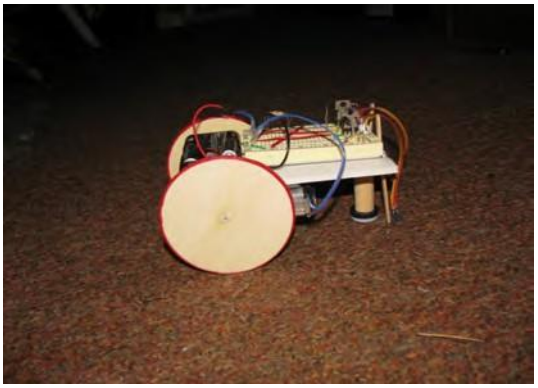
Line Follower: A Zippy Robot That Senses Where to Go
PART NO. 2170783



This kit has the parts you'll need with the exception of a few craft items sold separately to make a line-following cart. It uses a differential drive system to steer left or right to stay over a black line drawn over a white surface.

In addition to the parts here, you also need some foamcore or thin plywood, a small piece of double sided adhesive foam tape, craft sticks, a small piece of dowel and a furniture glide (all available easily at a box or home goods store)

Time Required: 8 hours or less depending on experience

Experience Level: Intermediate

Required tools and parts:

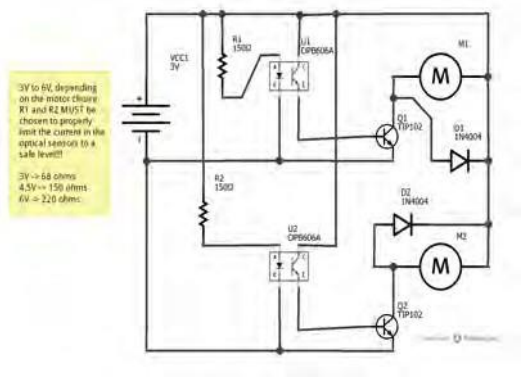
Soldering iron & solder
Long nose pliers
Double sided adhesive foam tape
Wooden discs for wheels Wooden
dowel for front support Standard
foamcore (3" x 5" piece)
Craft knife or other tools to cut foam and/or plywood
Large piece of white paper
Wide marker pen

Bill of Materials:

Qty	Jameco SKU	Component Name
2	32977	NPN transistor
Other NPN transistors could be used if they have the current carrying capacity		
10	35975	Silicon rectifier diode
2	2150432	Gearhead motor (pack of two)
1	20601	BREADBOARD 3.25X2.125 400PNT
2	1872628	REFLECTIVE OBJECT SWITCH SENSOR
1	639672	CABLE,RIBBON,10 CONDUCTOR,RAINBOW,28AWG,10 FEET,FLAT
This is *way* more cable then you need, but using small pieces of ribbon is a lot more convenient that separate wires		
10	691382	10 PACK OF 5% 1/4 WATT CARBON FILM RESISTORS, 150K OHM
You need two, out of a single pack of 10		
1	216303	3xAAA battery holder with cover and switch
2	(not included)	Wooden discs for wheels
This is a bag of 25 for $6 but the project only requires 2 - available from www.craftparts.com		
1	(not included)	Wooden dowel for front support
This is a 12" long 1/2" dowel. Only a few inches are required and this item is a bag of 5. One of the 5 will make several projects. - www.craftparts.com		
1	(not included)	Standard foamcore
This is an example of the material we want, but this source is a package of 8 sheets, 18" x 24". The project requires a single rectangle of 3" x 5". http://www.foamcore.com/183whfopa.html		
1	(not included)	Rubbery compound for making 'tires' (optional)
This is an optional step for giving the wheels traction. A single 14 oz can of this will make dozens and dozens of tires. I found it at an surplus tool store. It may not be an item you can ship easily (flammable and smelly) - www.plastidip.com		
4	198715	AAA batteries, 4 pack
1	(not included)	Glue
This can be any standard hardware store epoxy		

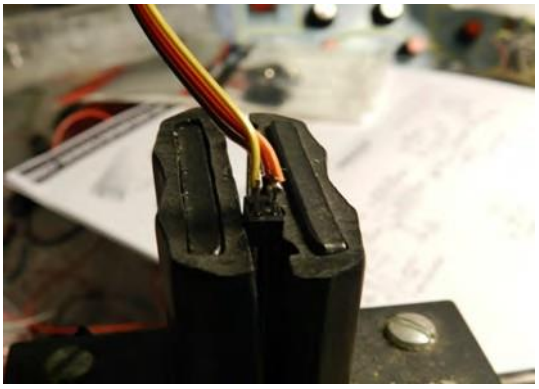
Step 1 - Assemble electronics

Using the transistors, resistors, diodes and breadboard wires, follow the schematic to assemble the circuitry on the breadboard. The optical sensors do not mount to the board directly.



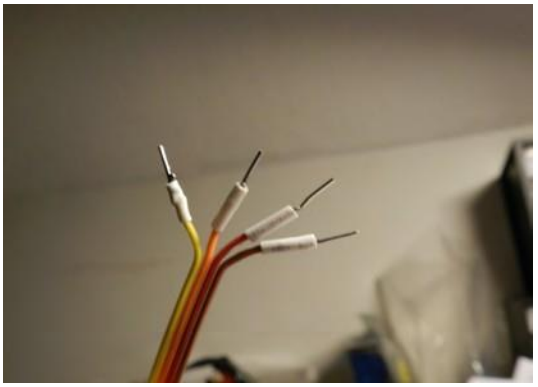
Step 2 - Attach wires to the sensors

The optical sensors will be mounted near the ground and have to be on a length of ribbon cable. Take two lengths of 4 conductor cable and attach the individual wires to the pins on the sensor.



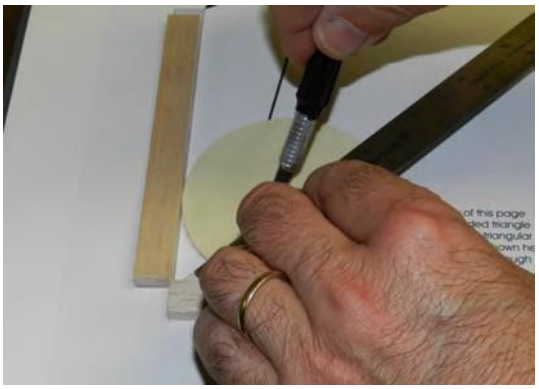
Step 3 - Attach breadboard connections to the sensor wires

Use short pieces of solid #22 wire, old cut off resistor leads or use short pieces of breadboard wire from a kit. Attach one to each of the wires on each sensor. You will be attaching 8 pins in all



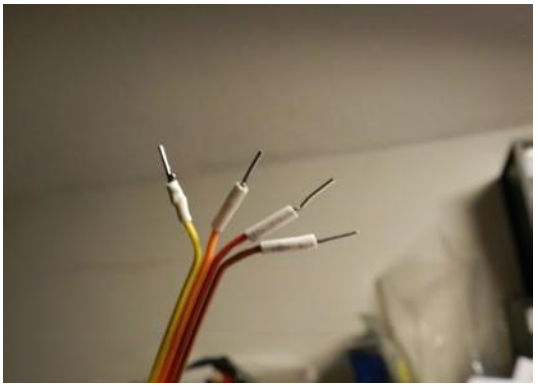
Step 4 - Make a circle center-finding template

Print out the PDF and mount it to a piece of foamcore or sturdy cardboard. Glue two wooden blocks as shown. To find the center of a circle, place the circle in the guide and place a straightedge along the diagonal on the template. Make a short score line with your knife. Rotate the circle a few degrees and repeat. Do this several times and they scores will intersect at the exact center.



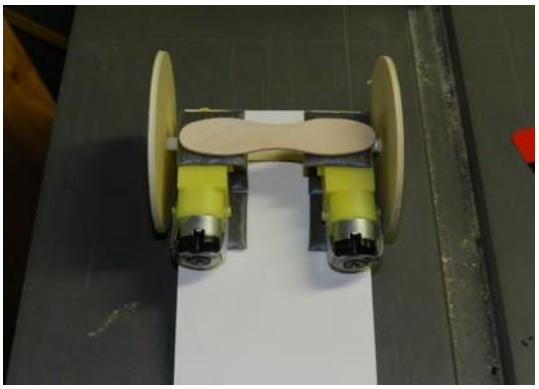
Step 5 - Attach the wheels

Drill the smallest hole you need to place the wheel on the motor shaft. Glue in place with super glue or epoxy. Be careful not to get glue into the mechanism. It does not matter which shaft you use on the motor.



Step 6 - Install motors & wheels

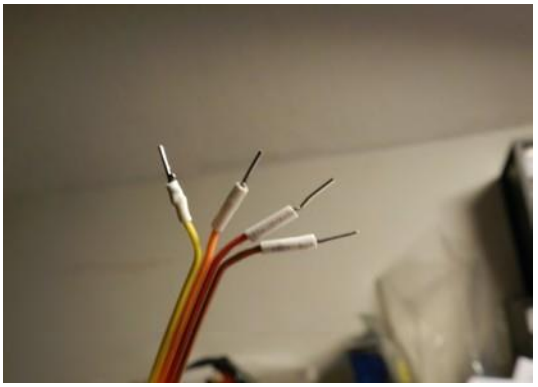
Mount the motors so that the wheels line up and are parallel with the chassis edges. A craft stick glue or tape across the bottom of the motors will help with rigidity.



Step 7 - Finish the chassis and wire the motors

Mount a furniture glide to a length of dowel, and cut the dowel to the right length to hold the front of the vehicle up horizontal. Glue it in place with epoxy.

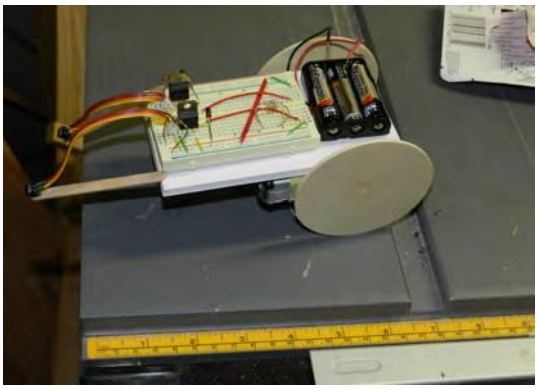
As you did with the sensors, prepare two lengths of ribbon cable. Solder one end of each to the motors and put pins on the other end.



Step 8 - Complete wiring

Place the breadboard on the chassis and mount with tape. Attach the four wires from each sensor according to the schematic if you haven't done so already. Plug the motor wires into their positions on the breadboard. Attach the battery. When you place a white object near a sensor, that motor will turn. Try the other motor. If they turn the wrong direction, simply reverse the wires.

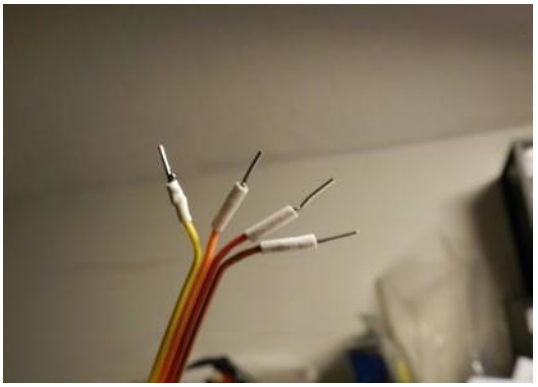
Mount the sensors near the glide using a craft stick and tape or some other scrap of material. The sensors should be spaced just a bit further apart than the width of your marker.



Step 9 - Making tires (optional)

Make a small boat of aluminum foil. IN A WELL VENTILATED AREA, pour in a shallow pool of the liquid compound. Let the motor run and slowly immerse the spinning wheel in the compound. After several revolutions, remove the wheel. If needed, wait a few minutes and repeat. Do the same with the other wheel.

ALLOW TO DRY for 24 hours



Step 10 - Draw a track

On a large piece of white paper or cardboard, use a broad marker and draw a line in a circle, oval, wiggly lines or other shapes. To start with, don't make the shape too intricate until you see how the follower performs.

Step 11 - 24 hours later...

Place the track you drew on a flat surface. Attach the battery to your board and place the robot so that the sensors are on either side of the line. If everything works, the robot should begin to move and turn as needed to keep the line in between the sensors.