

ECE 1001 / 1002 Introduction to Robotics

Lab #12: LineBot

Objectives

Follow arbitrary lines of various colors.

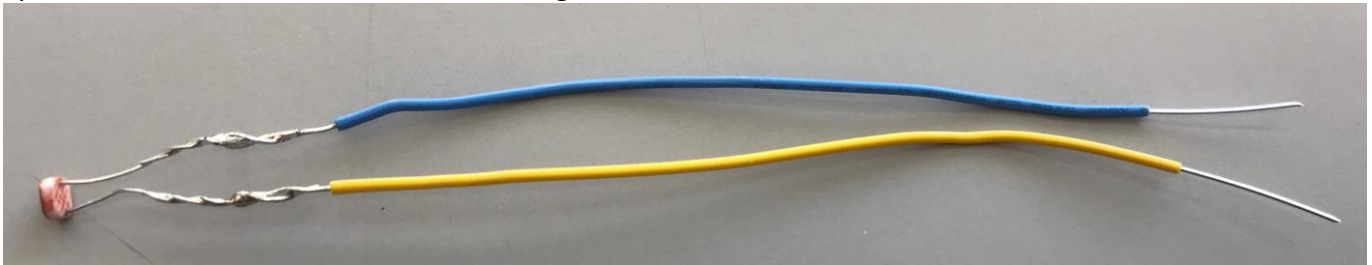
Introduction

You will need an Arduino robot which is able to

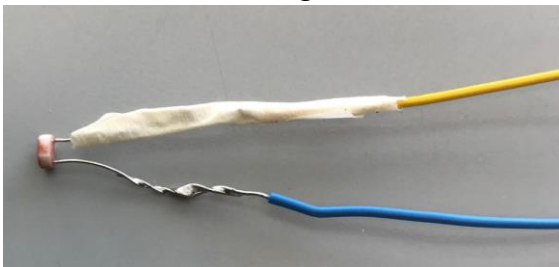
- Drive around on the table by itself.
- Respond to light from the photoresistor
- Display useful information on the LCD
- Respond to a button

The photoresistor needs to be within about $\frac{1}{4}$ " (one finger width) off the table facing down, there are various ways to do this, but you almost for sure need to extend the wire lead length. There is suitable wire and soldering equipment in room 229; You can do it yourself if you know how (please be neat and careful, cleanup and turn the iron off after use), I can show you briefly, or I can do it for you during class. To increase sensitivity of the photoresistor, it also helps to reduce stray light, this can be done with a black paper tube, I have paper and tape available for this during class. Construction of the Color sensor is shown below:

Spliced and soldered wires to extend the light sensor could look like this:



Insulate one or both legs



Wrap a tight black paper tube $\frac{1}{4}$ " to $\frac{1}{2}$ " from the end



If you have not installed the battery pack between the wheels to improve traction, this would be a good time to move it forward. If the wheels slip during turns, accurate line tracking will be more difficult.

The color duct tape your bot will follow is higher friction than the table surface and tends to catch the paper-clip tail drag; making repeatability problematic.

Requirements

1) The first problem is to find suitable light values for **white tape, red tape, yellow tape, green tape, and black table-top surface** – i.e. you are calibrating the Light sensor to act as a Color sensor. Once you know these values, you will be able to program your bot to recognize these colors and make specific actions based on that information.

Read and remember this: *sensing color is not easy, you need to control things such as the distance your sensor is from the table, angle your sensor has to the table, ambient light, shadows from you or other students hovering over your bot, and various other factors. Consistency of your robot depends on you making measurements which are consistent with what the robot will see. When your bot seems to no longer sense colors correctly you may need to re-calibrate.*

Build your bot capable of movement, but in this first task, just place your bot manually. Your bot should display the analog output (0 – 1023) of the Light/Color sensor to the LCD. Record values from various places on the table-top (black) and colored tapes. Adjust your light sensor to try and achieve the largest difference/separation between the colors. Find the minimum and maximum values for all the different colors. Then graph them on a number-line (0 – 1023) below. If light values overlap for different colors, try to adjust your sensor and/or re-read the previous paragraph. Find maximum and minimum values which are unique for each color. Don't be approximate, don't hurry, take lots of data.

0

1023

2) Place the Bot at one corner on the outer-edge of the white tape. The bot should wait until you start it with a button push. The Bot must follow the outer-edge of the white tape. It must follow around corners, although it can swing out, it must not reverse direction or hit a wall. For sign-off, you must complete at least one lap without crossing over the tape (outer edge to inner edge) or hitting a wall.

Report

Turn in your code and submit your signoff sheet by the deadline.

If you have this report to write, submit it to the report portal by the deadline