Task 2:-Controls+Robot Building Task

Introduction

At AGV, we aspire to create an autonomous vehicle that can navigate Indian roads. Autonomous driving works on the principle of sensing your surroundings and making driving decisions based on the input data. You will be implementing something along these lines in this task.

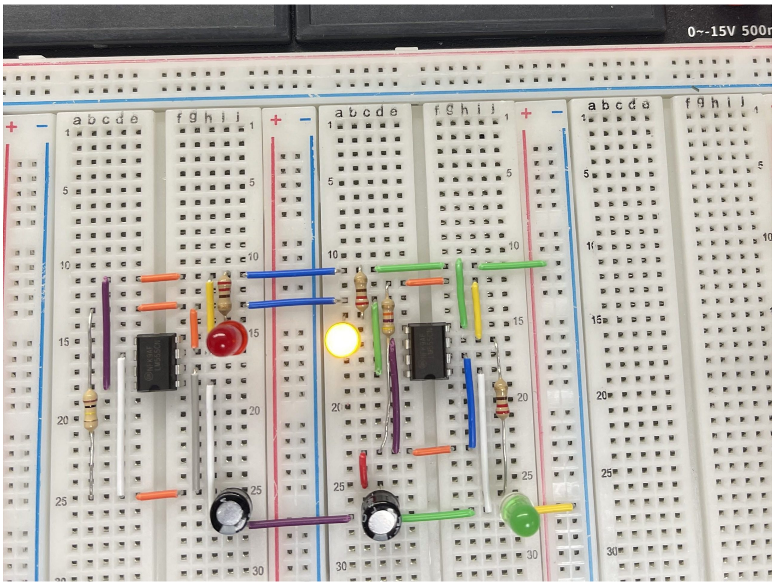
Task

You are required to do the following:-

1. Make a robot that can follow your hand, which also includes turning movements. The robot chassis should have two motors controlled by two different ultrasonic sensors (castor wheels may be used for support). An Arduino microcontroller (Uno/Nano) will be used, with a PID control algorithm implemented via the Arduino. The motors should be controlled by a single L293D motor driver IC.

2. Control the motor speeds using a PWM signal to the enable pins of the motor driver IC. The duty cycle of the PWM signals will be computed from the PID algorithm, and the error term has to be computed from the input of the ultrasonic sensors. Print the values of the error term and the PID output terms on a serial monitor.

3. You are encouraged to experiment with different values of the constants in the PID algorithm to find the optimum combination. Also, implement PD and PI algorithms on the same and compare the performances. Although it is preferred that the motor wires are soldered onto the motor pins, the circuits can be implemented on a breadboard. Albeit the breadboard circuit should have nice and flat single-stranded wires to make the breadboard-to-breadboard connections, like in the following example image:-



Bonus Tasks (these carry extra merit in evaluation hence you are highly encouraged to attempt these):-

1. If your hand gets too close to the robot, make it go backwards similar to the control for forward.
2. Try to implement the circuit on a perfboard and make the connections via soldering. Remember to use an IC base for the L293D IC, and female-to-male berg strip connectors if you are using an Arduino Nano to mount it onto the perfboard.

Make detailed documentation explaining all your steps, programming logic, etc. Report the optimum values of the PID constants, and also the comparison between the performances of PID, PI, and PD. Include your Arduino code with appropriate comments wherever needed in the documentation.

Resources

1. Chapter 6 (Control) from Elements of Robotics by Ben-Ari and Mondada
2. Video for learning perfboard soldering