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Mini Project Arduino Motor Controller Description

The motor control aspect of the Motor Mini-Project uses the motor driver Arduino shield and the built-in rotary encoder to give motor functionality. The Arduino code for localization waits for a byte message sent via I2C from the Raspberry Pi which indicates what quadrant the blue paper is detected in on the computer vision side. Once the byte is received, the system integration function outputs the angular position associated with the quadrant and stores it in a global variable.

The code in the main loop calls the PI controller function every 10 milliseconds so that the controller doesn't run too many times and produce an inaccurate integral term. The PI controller sets the error as the difference between the desired angle set by the Raspberry Pi and the current angular position that the motor is at. The integral term for the controller is set to the previous integral terms plus the error multiplied by the loop time. Using the current integral term and the PI controller gains obtained from Simulink, the value of the PWM duty cycle output used to modulate the motor speed is calculated. The directional pin for the motor is set either LOW for counter-clockwise rotation or HIGH for clockwise rotation depending on the sign of the PWM duty cycle. The controller then supplies the pin connected to the motor voltage with the PWM signal using analogWrite(M1_PWM, "duty cycle value"). The loop time is stored for use in the next integral term calculation.

The motor's built-in rotary encoder is used to check the current angular position of the motor using an ISR attached to one of the motor's encoder pins that is called when a change to the pin's state is detected. When the ISR is called, both pins of the encoder are read and if both pins have the same state, the encoder click counter is incremented by +2 counts; otherwise, the encoder counter is incremented by –2 counts. The ISR accounts for rollovers by resetting the counter if it goes over 3200 counts or under 0 counts. The counter is then scaled so that one revolution of the motor is equal to 2π radians to give the angular position.