

Homework #7a

LabVIEW

Dr. Pogo

Assignment is due on Tuesday, October 31, 2023

Assigned October 24, 2023

Assignment #7: Serial Control & Servo Motors

- Inputs:** A “calibrate” button, an “Active/Start” button, and a stop button
Two knob controls, and a VISA/COM selector for the robot
- Outputs:** Two LED indicators (GPIB device found or not found)
An array of 4 knob indicators representing knobs on a decade resistor
An array of 4 knob indicators showing values sent to the SG-6 robotic arm
- Hardware:** HP 34401A multimeter, 4 knob decade resistor, SG-6 robotic arm, USB-to-serial adapter

The main purpose of this program is to use a 34401A multimeter to monitor a decade resistor. The value of the decade resistor will then be used to control an SG-6 robotic arm. Since the robotic arm has 6 motors, and the decade resistor has only 4 knobs, the user will control two of the motors directly from the front panel. Each motor can accept 5000 unique inputs (ranging from 500 to 5500), but the knobs have only eleven settings (zero through ten). Furthermore, the user will only dial in values from zero through nine. These settings must be linearly scaled such that a 0 on the knob sends a 500 to the robot, and a 9 on the knob sends a 5500 to the robot. During development, do NOT turn on the robot until the motor indicators demonstrate that everything works perfectly! The robots are easy to damage! You will be assigned a particular robot arm that you are responsible for. Note that it is possible to turn on the robot controller without turning on the robot.

Use the physical COM port for the robot, and a USB emulated port for the multimeter. Your VI should automatically determine the correct COM Port for the multimeter and use it appropriately. The program should exit if a multimeter is not attached. The multimeter will read the total resistance of the decade resistor, which your program will parse into four separate values. The default “Twist” and “Finger” controls should be 3000.

“Active” is disabled until at least one calibration has been run. A calibration measures the R_0 value when all the knobs are set to zero, and also determines the magnitude of your particular resistor. I will use a different resistor than you do when I test it, so you should ensure your program works with differently sized decade resistors. At the end of a calibration, urge the user to set the decade resistor to 4525 (or other relaxed pose) before powering the robot or activating it.

Hints:

- To parse the resistance: convert integer of $(R - R_0)/R_{\min}$ into a string, and concatenate the string “0000” with the result. The rightmost four characters of this string can be converted to integers representing each knob.
- To calibrate the magnitude of the resistance when the lowest knob is set to “5”: Divide R by 5, round to the nearest integer, take the \log_{10} of the result, round this result, and raise 10 to the previous result.
- During the moments when an individual resistor knob is between settings, R will be almost random, which will jerk the robot around violently. To prevent this, only update the robot arm if *all* of the following are true:
 - a. the current R value is different than the last R value *sent* to the robot.
 - b. the current R value is the same as the previously *detected* R value.

