

## Homework #7

LabVIEW

Dr. Pogo

Assignment is due on Monday, March 29, 2010

Assigned March 12, 2010

### Assignment #7: GPIB

- Inputs:** A “calibrate” button, an “Active/Start” button, and a stop button  
A Serial/VISA resource control  
Two knob controls
- 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
- Operation:** All SubVI’s should have filenames in the form **07-LastnameFirstInitialFunctionname.vi**.  
Requires one HP 34401A multimeter, one 4 knob decade resistor, and one SG-6 robotic arm.

The main purpose of this program is to use a GPIB 34401A multimeter to monitor a decade resistor. The settings 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. Each motor can accept 5000 unique inputs (ranging from 500 to 5500), but the knobs have only eleven settings (zero through ten). Furthermore, you must coerce the value of each knob so that the accepted ranges are only 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 must sign out a particular robot arm before beginning.

Your VI should automatically determine the GPIB address of 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.

The user may change the VISA resource name only when the robot is not active. If it is changed, the program should reset the VISA task directly.

“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 5603 (a 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.

Remember that GPIB is slow, so don't expect immediate responses!

**Pogo's Assignment #7**

VISA resource name: COM1

34401A Missing! (Red LED)

34401A Found! (Green LED)

Calibrate

Active

Stop

**Resistor Bank**

Twist Control: 2500, 3500, 1500, 4500, 500, 5500, 3000

Finger Control: 2500, 3500, 1500, 4500, 500, 5500, 3000

Base Motor: 2500, 3500, 1500, 4500, 500, 5500, 0

Shoulder Motor: 2500, 3500, 1500, 4500, 500, 5500, 0

Elbow Motor: 2500, 3500, 1500, 4500, 500, 5500, 0

Wrist Motor: 2500, 3500, 1500, 4500, 500, 5500, 0