ECE 376 - Homework #5

Keypads in C, Stepper Motors, NeoPixels in C. Due Wednesday, February 22nd
Please email to jacob.glower@ndsu.edu, or submit as a hard copy, or submit on BlackBoard

Design an embedded system which uses the keypad and the NeoPixel. Some suggestions are...

- LED Flashlight: Input a number 0..255 on the keypad. Drive the NeoPixel at that brightness level (0..255) as white light (RGB all the same).
- LED Color Flashlight: Input a number 0..255 on the keypad. Set the brightness of RGB by pressing RB2 (R), RB1 (G), or RB2 (B).
- Starter Tree: Input a number on the keypad (N=0..100). When * is pressed, each light on the NeoPixel turns on one at a time with a delay of N*100ms per light.
- Other...

1) Requirements: Specify the inputs / outputs / how they relate.

2) C code, flow chart, and resulting number of lines of assembler

3) Validation: Collect data in lab to verify you met the requirements.

4) Demo. Video or in person.

Analog Inputs

5) Determine how long it takes to do an A/D conversion with a PIC processor

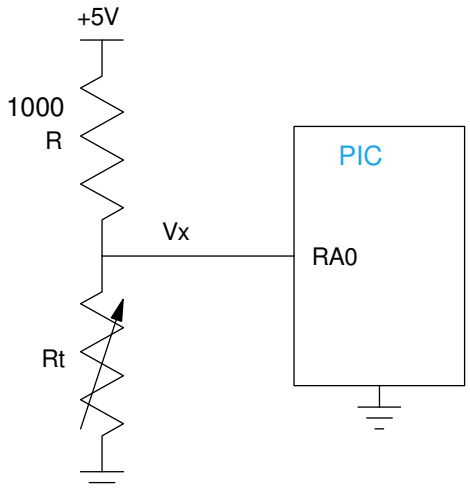
```
void main(void)
{
   TRISC = 0;
   ADCON1 = 0x0F;

// Turn on the A/D input
   TRISA = 0xFF;
   TRISE = 0x0F;
   ADCON2 = 0x95;
   ADCON1 = 0x07;
   ADCON0 = 0x01;

   while(1) {
      A2D = A2D_Read(0);
      PORTC = PORTC + 1;
      }
   }
```

6) Assume the A/D reads 713 for the following circuit.

- What is the voltage, Vx?
- What is the resitance, Rt?
- What is the temperature?

Assume

$$R_t = 1000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right)\Omega$$



Design an embedded system which uses the A/D input and a stepper motor. Some suggestions are...

- Ohm-Meter: Measure resistance using a voltage-divider. Display the resistance on the LCD display and on a stepper motor where 200 steps = 2k Ohms (10 Ohms per step)
- Thermometer: Measure temperature using a voltage-divider and a thermistor. Display the temperature on the LCD display and on a stepper motor where 200 steps = 100C (0.5C per step)
- Light Sensor: Measure light using a voltage-divider and a photoresistor. Display the light level in Lux on the LCD display and on a stepper motor where 200 steps = 1000 Lux (5 Lux per step)
- Combination Lock:
  - Input four numbers in the range of 0..20
  - Use the A/D input to adjust the number from 0..20 and RB1 to register that number in the combination
  - When RB0 is pressed, the last four numbers input are tested.
  - If they are the correct combination, the door opens (stepper motor turns 180 degrees, waits 1 second, the returns to zero position).
- Other

7) Give the requirements and flow chart for your program

8) C code and resulting number of lines of assembler

9) Validation: Collect data in lab to verify you met the requirements.

10) Demo. Video or in person.