Lab 1: Sensor Design and Analog Digital Conversion

Due Date: See the course syllabus or piazza page.

rev:09/11/17

Objectives

- Learn how to design sensors with embedded microcontrollers
- Understand the operation of ADC
- Understand the design of sensor circuitry
- Understand the operation of PWM signals
- Learn how to control a mechanical actuator such as servo motor

Description

It is often necessary that we understand the surrounding environment using sensors. To design sensors and their associated circuitry, and to obtain and processor sensory data are important tasks in the design of an embedded system.

In this lab, you will need to design a sensing and control system using a PIC microcontroller. That system will include a data acquisition operation using a light intensity sensor as an input to the system and two output devices: an LED diode and a Servo motor.

The parts given include a PIC16F18857, a photoresistor (LDR sensor), a LED and assorted diodes, resistors and a Servo motor. You can use a breadboard (or a wire-wrapping prototype board) to implement your circuit. The ADC module in PIC microcontroller will be used to convert an analog signal to corresponding digital value.

Implementation steps:

1. Convert the light intensity information to a variable voltage (0-3V).
2. Obtain an analog input signal (sensory data) via an analog pin of the PIC (e.g. AN0)
3. Use the internal ADC of PIC to convert analog signals to digital values
4. Turn on a LED if the sensor is encapsulated in a dark box or put in a dark environment.
5. Turn off the LED if the sensor is placed in a well-lighted environment.

6 . Enable and use the internal PWM module of PIC to control a Servo Motor which turn its blade to a specified degree.

7. Testing
    a. Fix a piece of cardboard on the motor-blade
    b. Place the motor close to the sensor is such a way to hide the LDR sensor with the cardboard

c. Develop a C program that controls the servo-motor in such a way that the cardboard blade covers and uncovers the LDR sensor triggering the LED correspondingly as the spec #4 and #5. You can set time intervals of 2 seconds between covering and revealing the sensor.

To sum up, you will need to design an embedded system where its actuator device (Servo motor) affects the sensor device (LDR) that triggers a visible indicator (LED light on/off).

Helpful Note: Use the UART-to-USB Cable along with PIC UART module which is already enabled in order to debug easier your code. Instructions are provided in *" Micro2_Lab_Introduction.pdf " file*

Deadlines:

See course schedule

Deliverables

See specified "Micro2_Lab_Introduction.pdf " file on Piazza and github repo.

Reference

[1] PIC16F18857 datasheet.
http://www.microchip.com/wwwproducts/en/PIC16F18857
[2] Lab Assignment materials on git repository :
http://github.com/yanluo-uml/micro2.git