ECGR6185, Spring 2010: Lab 1

Building a Distance Measuring Device

Learning Objectives

This lab will examine another sensor, a pressure sensor.

General Information

The general steps for this lab are:

1. Obtain a SRF10 from Prof. Conrad.
2. Correctly attach the sensor to your Renesas board.
3. Correctly build, test, and implement a voltage circuit to run the sensor and board.
4. Build the project and load onto your board. Run the program and observe the operation.
5. Demonstrate for a TA and turn in a lab report.

Introduction:

A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a gas or fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor generates an electric, optic, visual or auditory signals related to the pressure imposed.

Pressure sensors are used in numerous ways for control and monitoring in thousands of everyday applications. Pressure sensors can be used in systems to measure other variables such as fluid/gas flow, speed, water level, and altitude. Pressure sensors can alternatively called pressure transducers, pressure transmitters, pressure senders, pressure indicators among other names.

Pressure sensors can vary drastically in technology, design, performance, application suitability and cost. A conservative estimate would be that there may be over 50 technologies and at least 300 companies making pressure sensors worldwide.

There are also a category of pressure sensors that are designed to measure in a dynamic mode for capturing very high speed changes in pressure. Example applications for this type of sensor would be in the measuring of combustion pressure in an engine cylinder or in a gas turbine. These sensors are commonly manufactured out of piezoelectric materials like quartz.

Motivation:

The primary motivation for this project is that, the applications of pressure sensors are being increased day-by-day. It has got many applications in the field of weather instrumentation, aircraft, automotive and non-automotive.

The pressure sensor being used for this lab is the Freescale MPX4100A.

Requirements

Req. 1. The code generated is written in C for the SKP16C62P.
Req. 2. The code is well commented and easy to follow.
Req. 3. Measure the pressure inside a 20oz. drink bottle. It should show some change when the sealed bottle is squeezed.
Req. 4. Display the raw A/D value on the LCD.
Req. 5. Compute the Pounds per Square Inch (PSI) and display it to the hundreth's place on the LCD (i.e. 15.04 psi).
Req. 6. Be accurate within 0.05 psi
Req. 7. The code should be as compact as possible. Lab scores will be based on the size of the compiled object file. Smaller compiled code will result in a better score.
Req. 8. Your larger file must be submitted to Blackboard.
Req. 9. Req. 4 – The main objective is to use the SRF-04 (05) ultrasonic device to create a distance measuring device.
Req. 10. Req. 5 – Follow the guidelines for using the device found on the class webpage.
Req. 11. Req. 6 – When SW1 is pressed, take a measurement and display the results on the LCD.
Req. 12. Req. 7 – Display the distance in meters on the LCD in the form x.xxx. If the measurement is out of bounds, display 9.999.
Req. 13. Req. 8 – If the watchdog times out, the processor should reboot to the initial state.
Req. 14. Req. 9 – The software for this lab should use a state machine.
Req. 15. Req. 10 –Do not use floating point numbers for this lab.
Req. 16. Req. 11 – The device shall be a hand held, mobile device. Therefore, use the 9v to 5v regulator and 9v battery from Lab1.
Req. 17.

Lab Report

Include in the checkout part of your lab report the lines:

1. Display Raw ADC value _____
2. Display Computed Pressure _____
3. Display Pressure changes when the bottle is squeezed _____
4. Comments written as specified in requirements _____
5. Size of code (rank) _____/_____

Include in your lab report observations and procedure like the following:

The general learning objectives of this lab were . . .
The general steps needed to complete this lab were . . .
Some detailed steps to complete this lab were . . . .
1. Step one
2. Step two
3. . . . .
Code generated or modified to complete this lab...
No need to include all the files for the lab. Just include the modified code.
Some important observations while completing/testing this lab were . . .
Here include the memory report given at the end of the compile process (map file).
*We are **especially** interested in seeing the map file.*
In this lab we learned . . . .