ECGR6185, Spring 2010: Lab 4

Building a Distance Measuring Device - Low power

Learning Objectives

This lab will examine another sensor, a ultrasonic distance sensor. The primary goal is to operate at the lowest current level possible.

General Information

The general steps for this lab are:

1. Obtain a PING))) sensor from Prof. Conrad.
2. Correctly attach the sensor to your Renesas board.
3. Design the board and software to draw as little current as possible. This may require additional hardware.
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:

You may use the PCs in Woodward 203 or your own PC to do this lab experiment. The machines in Woodward 203 already have the software tools loaded. In this lab you will be utilizing onboard timers and I/O ports of the Renesas board to control an ultrasonic sensor.

There are three parts to this lab:

1) Operation of the ultrasonic sensor (interrupts, timers)
2) Setting the processor to run the software in low-power modes.
3) Possible creation of hardware that allows you to reduce current consumption.
4) Interfacing a 5v device with a 3.3 volt microcontroller.

Requirements

Req. 1. The code generated is written in C for the QSK62P.
Req. 2. The code is well commented and easy to follow.
Req. 3. The main objective is to use the Ping))) ultrasonic device to create a low-power distance measuring device.
Req. 4. Follow the guidelines for using the device found on the class webpage.
Req. 5. When SW1 is pressed, take a measurement and display the results on the LCD for at exactly 15 seconds. After 15 seconds, nothing should be displayed on the LCD.
Req. 6. Display the distance in meters on the LCD in the form x.xxx. If the measurement is out of bounds, display 9.999.
Req. 7. The software for this lab should use a state machine and interrupts.
Req. 8. Do not use floating point numbers for this lab.
Req. 9. The board runs at 3v, but the sensor runs at 5v. Therefore, create a circuit

Req. 10. 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. 11. The current consumption should be as low as possible. Lab scores will be based on the power consumption of the system. Lower current consumption will result in a better score.
Req. 12. Current consumption will be measured at three different times: while running the Ping))) sensor, while displaying the results, and after the display no longer displays the measurement.
Req. 13. Your code file, lab report, and map file must be submitted to Moodle as three separate files.

Sample Test Procedure

Note: Hand the lab checkout sheet to the TA when you demonstrate your program. You will turn in your code and report electronically. See the website for the score sheet.

Lab Report

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 . . . .

Upload to Moodle three files containing:

1. Your lab report (pdf). Name the file xxxxxxx_yyyyyyy_lab4.pdf, where xxxxxxx is the last name of one lab partner, and yyyyyyy is the last name of the other lab partner.
2. Your QSK62P Plus code (no need to include the sect30.inc, ncrt0.a30, LCD, or any .h files). Include all c code that you wrote (but if you are smart, this should be one small file so that the code size is small). Name the file xxxxxxx_yyyyyyy_lab4.c, where xxxxxxx is the last name of one lab partner, and yyyyyyy is the last name of the other lab partner.
3. Your entire map file. Name the file xxxxxxx_yyyyyyy_lab4.map, where xxxxxxx is the last name of one lab partner, and yyyyyyy is the last name of the other lab partner.

FAILURE TO FOLLOW THESE SIMPLE INSTRUCTIONS COULD RESULT IN THE LOSS OF POINTS.