ECGR6185, Spring 2010: Lab 2

Building a Distance Measuring Device

Learning Objectives

This lab will examine another sensor, a ultrasonic distance sensor.

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. 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:

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) Creation of hardware (voltage regulator) that allows hand-held operation.
3) 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 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.
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 device shall be a hand held, mobile device. Therefore, use a voltage regulator and a battery back.
Req. 10. The board runs at 3v, but the sensor runs at 5v. Therefore, create a circuit
Req. 11. 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. 12. Your code file and lab report must be submitted to Blackboard as two separate files.

Lab Report

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

1. Display distance correctly _____
2. Operates as hand-held device _____
3. Comments written as specified in requirements _____
4. 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 . . . .

One solution is an optical isolator (or opto isolator, or optical coupler, or optocoupler) is a device which will allow you to connect two different circuits logically, but not electrically. There are many variants: AC to DC, DC to DC, etc. In the past we used two H11AA1 parts, which are labeled "AC input/phototransistor optocoupler". You can also try a 4N25 (available from the ECE from a lab carts).