UNC Charlotte, ECGR 6185/8185, Spring 2013: Lab 5

uC/OS-III on Renesas

Learning Objectives

This lab will have students familiarize themselves with an embedded operating system, uC/OS-III and write an application to use the TI MSP430 to send data to the Renesas RX62N.

Laboratory Assignments

You may use the PCs in EPIC 2148 or your own PC to do this lab experiment. The machines in EPIC 2148 should already have the software tools loaded. In this lab you will be reading two analog port pin of the TI MSP430 board to read the accelerometer and write to three port pins to light LEDs. Follow the guidelines for using the device found on the sparkfun.com website (SEN-09652). Also, visit the TI website for more information about the TI MSP430. uC/OS-III, the real-time embedded operating system will be loaded onto the RX62N. You will send the data (raw ADC values or real G forces) to the RX62N board, storing in a shared variable protected by a semaphore. Use the LCD to display the values.

OS Instructions

Download the Renesas MicroC/OS-III port from Micrium website using this link:

http://micrium.com/downloadcenter/download-results/?searchterm=hm-renesas&supported=true

You should find it under Micrium Book Projects.

Steps

1. Build your hardware system. DO NOT SOLDER components to the TI Launchpad board (only headers). Consider making your own board to hold the SOCKETED TI MSP430 chip.
2. Make sure you have uC/OS-III successfully running on your board.
3. Write the program as one .c and one .h file.
4. Repeat software development until done!
5. Finish lab write-up and demonstrate for the TA.
6. Submit your report and C code (*.c) on Moodle.

Requirements

Req. 1 - The code generated is written in C for the TI MSP430 Launchpad Board and the RX62N Board.

Req. 2 - The code is well commented and easy to follow.

Req. 3 - The main objective is to use the accelerometer (analog-based) to make a carpenter's level. The long part of the level can be a ruler or any piece of wood/metal that weighs 0.5kg or less and is at least 30cm long.

Req. 4 - The level electronics part can be any size, but must have at least the socketed MSP430 processor, a power source, an accelerometer, three LEDs, and one button.

Req. 5 - The level shall work on its own power (i.e. battery), and shall not be power-tethered during operation.

Req. 6 - The level need work only in the horizontal plane.

Req. 7 - The button shall serve as a "calibration" function. When it is pressed, the level (whatever position it is in) shall be declared "level" to earth's gravity and every measurement after that is determined based on the calibration.
Req. 8 - uC/OS-III is running on the RX62N board.
Req. 9 – With interrupts disabled, a continually running task is created with the measured values stored into a shared variable protected by a semaphore.
Req. 10 - The level shall operate such that the LEDs of two different colors in a row, center of a different color (i.e. yellow-red-yellow) indicate if the device is level or at an angle. If the device is level, the center light will light up. If the left side is higher, the left LED will light up. If the right side is higher, the right LED will light up. Only one LED should light up at a time.
Req. 11 - The device shall report an angle of 3% or less as level; otherwise, it should light one of the end LEDs.
Req. 12 – Create a task to display the G-forces or raw ADC value of the X and Y axis' on the LCD on the RX62N in the form x.xxx or xxxx one line for each axis for each sensor. For example, the lines should be:

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X = x.xxx (or xxxx)
Y = x.xxx (or xxxx)
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Req. 13 – Also display on the RX62N board the same bubbles as are lit on the MSP430 board. Use any characters or mechanism (i.e. graphics) you wish.
Reg. 14 – You may communicate between the two boards in any way you wish. There is no longer a penalty for wired communications.

Lab Report

Include in your lab report observations and procedure like the following:
The general learning objectives of this lab were . . .
Pre-lab question answers
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 for this lab…
Some important observations while completing/testing this lab were . . .
In this lab we learned . . . .