

CDA 3631C Embedded Operating Systems

LAB ASSIGNMENT 6: Real Time OS (RTx5)

Date Posted: 23 November 2019

Date Due: 09 December 2019 (11:59 PM)

Concept:

- Use the Keil's RTX5 embedded real-time operating system to efficiently and properly control peripheral devices on the on the Cortex-M3.

Files Needed:

Lab6EOS.zip

Introduction:

In this lab, you will implement a digital clock using an example project as the starting point. This may not be the method some would choose to implement a clock, but the focus is on correctly learning the use of the RTOS, threads, semaphores, and mutexes with only a little computation necessary.

Assignment:

Download the zip file (stated above) from Canvas and unzip it. This project uses the RTX5 RTOS to write a static time to the LCD display in military HH:MM:SS format. It also configures and enables the EXTI15 edge-triggered interrupt for the evaluation board's USER pushbutton. In the example, the EXTI15's ISR uses an improper method to increment the minutes. For this lab, you must add code to this project to finishing implementing a fully-functional clock. The project must meet the requirements below:

- No ISR may read or write to a shared variable (I.e. one that is accessed elsewhere in the code).
- No shared variable may be accessed without correctly acquiring a correlated mutex.
- You must use the existing three variables hours, minutes, and seconds to track the corresponding values for the time.
- There must be one and only one thread that may modify/increment the value for seconds.
- There must be one and only one thread that may modify/increment the value for minutes.
- There must be one and only one thread that may modify/increment the value for hours.
- There must be one and only one thread that writes the time to the graphic LCD. The format must be in HH:MM:SS and use military time (hours count from 0 to 23). The time must be centered horizontally and vertically in the screen. To be efficient, this thread must only write the time to the screen when there is an updated value.
- The values for seconds must increment at a rate of 1 Hz (hopefully this is obvious, and hint, you'll need another thread for this.)
- The USER button must trigger an edge-triggered interrupt so that depressing the USER button increments the value for minutes by 1. (Hint: The ISR exists, but you'll need to replace the write with a semaphore.)
- The WAKEUP button must trigger an edge-triggered interrupt so that depressing the WAKEUP button increments the value for hours by 1. This will require a separate ISR similar to the existing one.
- Each thread routine must be contained in its own file, and all items must be logically named.

- Every file must be commented, including a header with standard info and a brief, specific description of the contents.

Deliverables:

- 1) Entire project in Zip file.
- 2) Include a video demonstration.
- 3) There is NO PDF report to submit for this LAB. But you MUST demonstrate to instructor before the Final exam on 9th December,2019.