ELEC 5260 Final Project – Real Time Operating System (RTOS)

Due: Friday, April 28, 2017 by 3:00 pm (no late assignments will be accepted)
(For extra credit – you may submit the ELEC 6260 project in place of this one.)

Exercise the ARM/CMSIS-RTOS Real-Time Operating System on the STM32F4-Discovery board, demonstrating it with the following set of Threads.

- **Thread T1**: Via a message queue, send a message every 10 seconds to Thread T2. The “message” is to be the number of messages, M, sent thus far. Blink LED3 on and off twice in one second to indicate that a message has been sent. When the message count reaches 5, reset the message count to 0.

- **Thread T2**: Receive messages from Thread T1 and blink LED4 M times, where M is the message content. This process should wait and execute only when a message is received.

- **Thread T3**: Blink LED5 on and off once per second, for a period of 20 seconds. This LED should be considered a “resource” that needs to be **locked** by acquiring a “mutex”, which is to be released at the end of the blinking period. This will ensure that only T3 is controlling the LED. Thread T4 is to use this same mutex and resource.

- **Thread T4**: Blink LED5 on and off once per half second for a period of 20 seconds. This is the same LED resource used by Thread T3, and therefore needs to be **locked** by acquiring the mutex and then releasing it at the end of the blinking period.

- **Thread T5**: Signal an “event” to Thread T6 every 30 seconds and turn LED6 on to show that the event has been signaled.

- **Thread T6**: Turn LED6 off two seconds after detecting the event signal from T5.

<table>
<thead>
<tr>
<th>LED3</th>
<th>LED3 (orange) = I/O port pin PD13</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED4</td>
<td>LED4 (green) = I/O port pin PD12</td>
</tr>
<tr>
<td>LED5</td>
<td>LED5 (red) = I/O port pin PD14</td>
</tr>
<tr>
<td>LED6</td>
<td>LED6 (blue) = I/O port pin PD15</td>
</tr>
</tbody>
</table>

CMSIS-RTOS message queue functions are to be used to send and receive messages. CMSIS-RTOS mutex functions are to be used to control access to the counter resource. CMSIS-RTOS signal event functions are to be used to signal and detect events.

**CMSIS-RTOS RTX Information and Resources**


- On page 33 of that document is a link to the Keil web site that contains complete information on CMSIS-RTOS RTX, including tutorials for creating projects, configuring CMSIS-RTOS RTX, and using the different RTOS functions and data structures. [http://www.keil.com/pack/doc/CMSIS/RTX/html/index.html](http://www.keil.com/pack/doc/CMSIS/RTX/html/index.html)

- The Keil installation directory has a sample “Blinky” project that uses CMSIS-RTOS RTX. On my PC this is located at: C:\Keil\ARM\Pack\Keil\STM32F4xx_DFP\2.11.0\MDK\Boards\ST\STM32F4-Discovery\Blinky

You can copy this to your own directory. Open the “Pack Installer” (button in the menu bar), select STM32F4-Discovery in the “Boards” tab, and then select CMSIS-RTOS Blinky in the “Examples” tab.