ECE3623 Embedded System Design Laboratory

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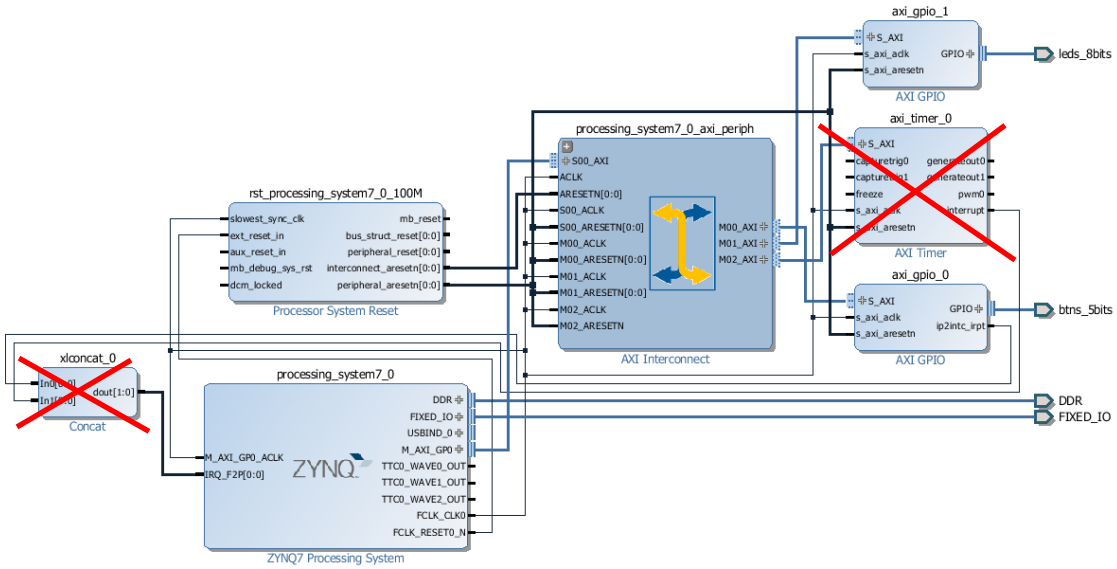
FreeRTOS Software Timer

In this Laboratory you will utilize the embedded development of a Vivado Zynq Processor System (PS) with the FreeRTOS software timer rather than the hardware AXI timer used in Lab 4. The *Zynq Book Tutorial* program *interrupt_controller_tut_2D.c* used the hardware AXI timer and hardware interrupts. Here you are to replace the functionality of the hardware AXI timer with the FreeRTOS software timer which has additional processes.

The Vivado hardware design in this Lab does not use the AXI timer and BTN interrupt processing or the *concat* IP block inherent in the *Zynq Book Tutorial* Exercise 2D:



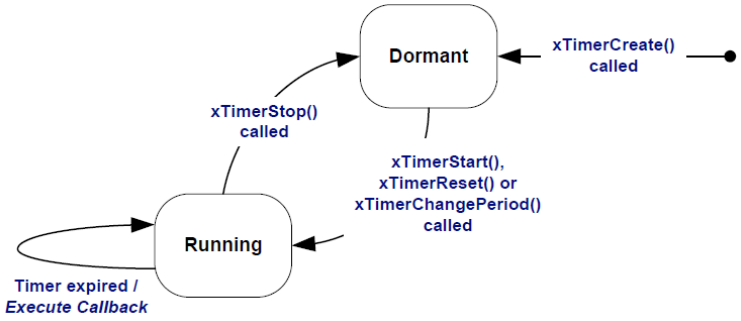
The Laboratory specifications are as follows:

- The hardware design is to use a single, two channel GPIO for the LEDs and BTNs.
- The LEDs are initially set as 1001 (LED3 ON, LED2 and LED1 OFF and LED0 ON).
- The BTNs do not use hardware interrupts since the tasks will execute in FreeRTOS.

- The *prvTimerCallback()* API function in FreeRTOS is to be used as a software timer equivalent to the simplier AXI hardware timer with the command queue in FreeRTOS.
- The software timer initially has an auto-reload period of 5 seconds and the callback function upon expiration toggles the LEDS (1001 → 0110 → 1001…) and is started.
- If BTN0 is depressed, the software timer is reset. The affect upon the expiration timing for toggling the LEDS should be demonstrated (see Introduction to FreeRTOS PPT slide 248).
- If BTN1 is depressed the period of the software timer is changed to 2.5 seconds. The affect upon the expiration timing for toggling the LEDs should be demonstrated.
- If BTN2 is depressed the software timer is stopped and the LEDs are OFF (0000).
- If BTN3 is depressed the software timer period is restored to 5 seconds and started and the LEDs are set to 1001.

The FreeRTOS include files must have timers.h:

```
/* FreeRTOS.org includes. */
#include "FreeRTOS.h“
#include "task.h"
#include "timers.h"
```



This Laboratory is for the week of April 6th and due no later than Sunday April 12th 11:59 PM with an upload to Canvas of the Project Report with documentation of task completion.