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Re: Lab 2 Report

## Overview

The objective of this lab exercise was to cycle 2 pairs of LEDS through different on-off configurations at independent frequencies, utilizing the cooperative multitasking strategy.

## Tasks

**Task 1: Pattern\_1**:

Hardware interfacing code for LED Pair 1: this task cycles through different states of activation for the green and red LEDs in sequential order. The frequency with which they are changed is handled by Task 2: Timing\_1.

States:

The following states are different on-off combinations of which the two LEDs which are cycled though.

* t1state0\_init: Initialization: Set both LEDs to off, move to t1state1 on next cycle
* t1state1\_G1R0: G\_LED\_1 ON and R\_LED\_1 OFF
* t1state2\_G0R0: G\_LED\_1 OFF and R\_LED\_1 OFF
* t1state3\_G0R1: G\_LED\_1 OFF and R\_LED\_1 ON
* t1state4\_G0R0: G\_LED\_1 OFF and R\_LED\_1 OFF
* t1state5\_G1R1: G\_LED\_1 ON and R\_LED\_1 ON
* t1state6\_G0R0: G\_LED\_1 OFF and R\_LED\_1 OFF

**Task 2: Timing\_1:**

Timing control for LED Pair 1/Pattern\_1 cycling: this task decrements the COUNT\_1 variable each pass through Task 2 that the DONE\_1 variable is 0. Changing the starting number of ticks in TICKS\_1 (and thus COUNT\_1) changes the frequency of blinking. Since one pass through the delay Task occurs between each decrement of timing\_1, the period between LED state changes is 1ms\*TICKS\_1.

States:

* t2state0\_init: This is the initialization state that resets TICKS\_1 to COUNT\_1, clears DONE\_1, and sets t2state to 1 so that it goes into the increment cycle.
* t2state1\_decrement\_C1: This is the state that decrements the COUNT\_1 variable during each pass through Task 2.

**Task 3: Delay:**

This task creates the 1ms delay between LED update cycles. It has a loop that decrements from $0584 to 1, which based on the clock speed takes about 1ms. This task is completed after every time tasks 1-4 are run, thus allowing timing\_1 or timing\_2 to set approximate frequencies of the LEDs.

States:

* t3state0\_init: initialization for TASK\_3
* t3state1\_delayloop: jumps to DELAY\_1ms subroutine which has loop that creates delay of 1ms

**Task 4: Pattern\_2:**

Hardware interfacing code for LED Pair 2, this task cycles through different states of activation for the green and red LEDs in sequential order. The frequency with which they are changed is handled by Task 5: Timing\_2.

States:

The following states are different on-off combinations of which the two LEDs which are cycled though.

* t2state0\_init: Initialization: Set both LEDs to off, move to t2state1 on next cycle
* t2state1\_G1R0: G\_LED\_2 ON and R\_LED\_2 OFF
* T2state2\_G0R0: G\_LED\_2 OFF and R\_LED\_2 OFF
* T2state3\_G0R1: G\_LED\_2 OFF and R\_LED\_2 ON
* T2state4\_G0R0: G\_LED\_2 OFF and R\_LED\_2 OFF
* T2state5\_G1R1: G\_LED\_2 ON and R\_LED\_2 ON
* T2state6\_G0R0: G\_LED\_2 OFF and R\_LED\_2 OFF

**Task 5: Timing\_2:**

Timing control for LED Pair 2/Pattern\_2 cycling: this task decrements the COUNT\_2 variable each pass through Task 4 that the DONE\_2 variable is 0. Changing the starting number of ticks in TICKS\_2 (and thus COUNT\_2) changes the frequency of blinking. Since one pass through the delay Task occurs between each decrement of timing\_2, the period between LED state changes is 1ms\*TICKS\_2.

States:

* T2state0\_init: This is the initialization state that resets TICKS\_2 to COUNT\_2, clears DONE\_2, and sets t2state to 1 so that it goes into the increment cycle.
* T2state1\_decrement\_C2: This is the state that decrements the COUNT\_2 variable during each pass through Task 2.

**Inter-Task Communication Variables**

|  |  |  |  |
| --- | --- | --- | --- |
| Communication Variable | Description | Variable Cleared | Variable Set |
| DONE\_1 | Is decrement of one period of LED pair 1 is done | Task\_2: State 1 | Task\_2: State 1 |
| DONE\_2 | Is decrement of one period of LED pair 2 is done | Task\_5: State 1 | Task\_5: State 1 |
| COUNT\_1 | Variable decremented for time-keep of LED pair 1 | Task\_2: State 1 | Task\_2: State 1 |
| COUNT\_2 | Variable decremented for time-keep of LED pair 2 | Task\_5: State 1 | Task\_5: State 1 |

**Finite State Machine Diagrams:**

The following figures contain the finite state machine diagrams for Task 1-5:

Diagram

Description automatically generated

Figure 1. Task\_1: Pattern\_1 Finite State Machine Diagram

Diagram, engineering drawing

Description automatically generated

Figure 2. Task\_2: Timing\_1 Finite State Machine Diagram

Diagram

Description automatically generated

Figure 3. Task\_3: Delay\_1ms Finite State Machine Diagram

Diagram

Description automatically generated

Figure 4. Task\_4: Pattern\_1 Finite State Machine Diagram

Diagram, engineering drawing

Description automatically generated

Figure 5. Task\_5: Timing\_2 Finite State Machine Diagram

### Source Code: See addended .pdf