ENCM 511 Assignment1

Preamble

A computer screen with text and numbers

AI-generated content may be incorrect.

The above definitions have been added at the start of the code to improve readability. Their corresponding pin mapping may be referenced in the image above. LED2 is unused in this lab and is commented out for that reason. Global ISR priority and debounce time variables have also been created to allow for easy adjustment.

A screenshot of a computer program

AI-generated content may be incorrect.A computer screen with text and images

AI-generated content may be incorrect.Peripherals

Above is the IO\_init and timer\_init functions to be called at the beginning of main to configure IO pins and timers on the microcontroller. Line functions are elucidated by their comments.

Datatypes and Initialization

A math equation with black text

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The state variable will be in the range of 0 to 3 and thus is an unsigned 8bit integer.

The milliseconds variable will be in the range of 0 to 4000 and thus is an unsigned 16bit integer.

The i variable will be in the range of 0 to 444 and thus is an unsigned 16bit integer.

Operation

The code was architected with the goal of allowing the button state (i.e. which light is flashing) to be changed quickly and not be forced to wait for the expiration of the last state which could be quite long in the case of the 2 second blink.

This was achieved by first determining the sate of the buttons at the beginning of the main loop.

A close-up of a computer code

AI-generated content may be incorrect.This gives 4 possible states and is stored in the state variable.

A screenshot of a computer program

AI-generated content may be incorrect.The LEDs are then updated depending on the current value of the milliseconds variable and the updated button state.

A calendar with a blue dot on it

AI-generated content may be incorrect.This logic results in the following diagram for each LED vs the milliseconds variable. Each LED only receives its counting pattern if the appropriate state is active.

After the LED update NOP instructions are added to increase the time of the loop to approximately 1 millisecond.

A close up of a text

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Then the milliseconds counter is incremented and checked for a periodic reset at 4000ms as this is the longest period required for any of the LEDs and can be looped after this point.

A white background with black text

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This means the longest response time to a change in the button inputs is approximately 1ms.