Lab Activity-III
Timer and GPIO Interrupts

Module Name- Embedded C

KPIT Technologies Ltd.

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Lab activity III – Timer and GPIO Interrupts

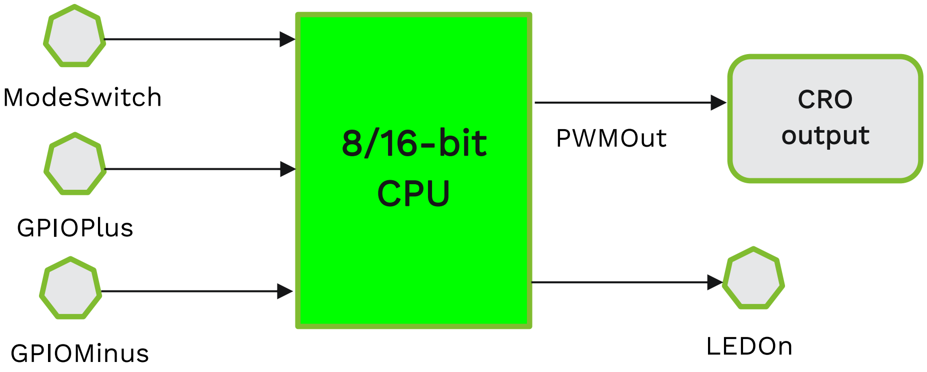
Design a modular program for the given system and simulate/test it for a given problem statement as described below:

The system is in two modes as per below details:
Stand-by mode:
Once system is power on and ModeSwitch is open, the system is in standby mode. In standby mode LEDOn blinks continuously with delay of 1000msec (Use Timer0 Overflow interrupt to create delay).

Application mode:
System enters application mode once ModeSwitch closes and creates 50% duty cycle on PWMOut pin.
The main applications respond to two switch interrupts, GPIOPlus and GPIOMinus as per below details.

- Duty cycle (delay between ON and OFF) is going to be increased by 10% for each GPIOPlus switch press until 100% duty cycle is reached.
- Duty cycle (delay between ON and OFF) is going to be decreased by 10% for each GPIOMinus switch press until 0% duty cycle is reached.

Once ModeSwitch is open, system once again go to standby mode and retain current value of duty cycle, which need to be restored while entering in application mode.



Note:
Design 2 ISR's each for GPIOPlus and GPIOMinus switches to indicate whether switch is close or open.
Configure Timer0 INT in overflow mode to create delay of 1000msec in standby mode.
Use inbuild delay function _delay_ms() to create any custom delay between ON and OFF interval in order to generate PWM in application mode.
Observe PWM (ON and OFF cycle) on specific PWMOut pin using oscilloscope. Chose a reasonable frequency for PWM pulse so that wave is visible in oscilloscope.

Guidelines to Design modular program:

The modular program consists of 3 separate .c files (GPIO.c, ModeState.c and AppMode.c) and corresponding header .h file (GPIO.h, ModeState.h and AppMode.h).
Identify main API's or functions for each .c file.

The files need to be submitted in the zip folder having unique ID:

- Module Implementation files [.c files] and corresponding header files [.h files]
- Main program [.c file] to test as per problem statement and must have defined external Interrupt ISRs
- .HEX file
- Simulation circuit [.simu file]

Important online references:

http://isa.uniovi.es/docencia/redes/EmbeddedSatateMachinesImplementation.pdf

https://www.codeproject.com/Articles/1275479/State-Machine-Design-in-C

https://github.com/crapp/finis

GPIO.h Header file template

```
******************************************************************************
* File Name: GPIO.h
* Description:  This file contains function Prototypes of GPIO.c
* Tool-Chain: AVR GCC
*
* Modification History:
*  Created by:      username    V1.0      27/Jul/15
*  Description:     V1.0
*
******************************************************************************/
#ifndef GPIO_H
#define GPIO_H

/*******************************************************************************
*                       Includes
*******************************************************************************/
#include "TCD_Types.h"
/*******************************************************************************
*                       Defines and data types
*******************************************************************************/
/*******************************************************************************
*                       Global variables
*******************************************************************************/

/*******************************************************************************
*                       Public function prototypes
*******************************************************************************/
#endif
/*******************************************************************************
*                       End of File
*******************************************************************************/
```

GPIO.c implementation file template

```
/*******************************************************************************
* File Name: GPIO.c
* Description:  This file contains API definitions for GPIO functionality
* Tool-Chain: AVR GCC
*
*  Modification History:
*  Created by:      Username    V1.0      27/Jul/15
*  Description:     V1.0
*******************************************************************************/

/*******************************************************************************
*                      Includes
*******************************************************************************/
#include "GPIO.h"

/*******************************************************************************
*                      Defines and data types
*******************************************************************************/

/*******************************************************************************
*                      Global variables
*******************************************************************************/

/*******************************************************************************
*                      Static variables
*******************************************************************************/

/*******************************************************************************
*                      Internal function prototypes
*******************************************************************************/
/*******************************************************************************
*                      Public functions definitions
*******************************************************************************/
/*******************************************************************************
* Name: GPIOConfig (pin, mode)
* Description:  Configures the mode of the pin as INPUT/PULLUP or OUTPUT

* Arguments: pin and mode
* Returns: None
*******************************************************************************/
/*******************************************************************************
*                      Internal functions
*******************************************************************************/
/*******************************************************************************
* Name:
* Description:
*******************************************************************************/
/*******************************************************************************

/*******************************************************************************
*                      End of File
*******************************************************************************/
```