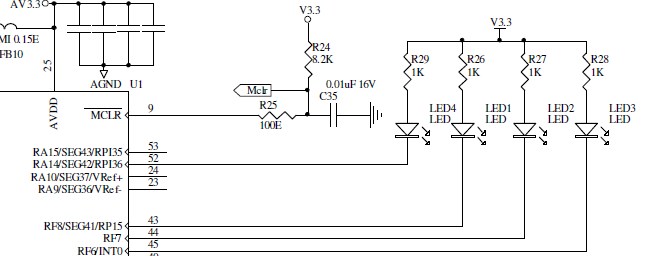
**Autonomous Tractor Safety System**

**Objective 2.0** To demonstrate four blinking LEDs based on time in ATSS PCB board using Timer1 interrupts

****

**TRISF** DATA DIRECTION REGISTER F: 0x0000

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TRISF15 | TRISF14 | TRISF13 | TRISF12 | TRISF11 | TRISF10 | TRISF9 | TRISF8 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
|  |  |  |  |  |  |  | 0 |
|  |  |  |  |  |  |  | Output |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TRISF7 | TRISF6 | TRISF5 | TRISF4 | TRISF3 | TRISF2 | TRISF1 | TRISF0 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
| 0 | 0 |  |  |  |  |  |  |
| Output | Output |  |  |  |  |  |  |

**TRISA** DATA DIRECTION REGISTER A: 0x0000

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TRISA15 | TRISA14 | TRISA13 | TRISA12 | TRISA11 | TRISA10 | TRISA9 | TRISA8 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
|  | 0 |  |  |  |  |  |  |
|  | Output |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TRISA7 | TRISA6 | TRISA5 | TRISA4 | TRISA3 | TRISA2 | TRISA1 | TRISA0 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

**LATF** OUTPUT LATCH REGISTER F: 0x01C0

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| LATF15 | LATF14 | LATF13 | LATF12 | LATF11 | LATF10 | LATF9 | LATF8 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
|  |  |  |  |  |  |  | 1 |
|  |  |  |  |  |  |  | LED1 off |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| LATF7 | LATF6 | LATF5 | LATF4 | LATF3 | LATF2 | LATF1 | LATF0 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
| 1 | 1 |  |  |  |  |  |  |
| LED2 off | LED3 off |  |  |  |  |  |  |

**LATA** OUTPUT LATCH REGISTER A: 0x4000

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| LATAF15 | LATA14 | LATA13 | LATA12 | LATA11 | LATA10 | LATA9 | LATA8 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
|  | 1 |  |  |  |  |  |  |
|  | LED4 off |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| LATA7 | LATA6 | LATA5 | LATA4 | LATA3 | LATA2 | LATA1 | LATA0 |
| I/O | I/O | I/O | I/O | I/O | I/O | I/O | I/O |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

**T1CON TIMER1 (16 BIT) CONTROL REGISTER**: 0x8020

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TON | - | TSIDL | - | - | - | TIECS1 | TIECS0 |
| TIMER1 ON |  | T1 STOP IN IDLE MODE |  |  |  | TMR1 EXTENDED CLKC SRC SELECT (WHEN TCS = 1) | |
| 1 | - | 0 | - | - | - | 0 | 0 |
| T1 START |  | T1 CONTINUES IN IDLE MODE |  |  |  | IGNORE | IGNORE |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| - | TGATE | TCKPS1 | TCKPS0 | - | TSYNC | TCS | - |
|  | T1 GATED TIME ACCUM EN | T1 PRESCALE SELECT | |  | T1 EXT CLK SYNC (WHEN TCS = 1) | T1 CLK SRC SELECT |  |
| - | 0 | 1 | 0 | - | 0 | 0 | - |
|  | DISABLE | T1 PRESCALE 1:64 | |  |  | INT CLK (Fosc/2) |  |

**IFS0 INTERRUPT FLAG STATUS REGISTER 0**: 0x0000

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| - | DMA1IF | AD1IF | U1TXIF | U1RXIF | SPI1IF | SPF1IF | T3IF |
|  | DMA CH1 INT | ADC1 COMPLETE | UART1 Tx REQUEST | UART1 Rx REQUEST | SPI1 INT OCCURRED | SPI1 FAULT INT | TMR3 INT REQUEST |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| T2IF | OC2IF | IC2IF | DMA0IF | T1IF | OC1IF | IC1IF | INT0IF |
| TMR2 INT REQUEST | O/P CMP CH2 INT | I/P CH 2 CAPTURE | DMA CH0 INT | TMR1 INT REQUEST | O/P CMP CH1 INT | I/P CH 1 CAPTURE | EXT TNT CH0 INT |
|  |  |  |  | 0 |  |  |  |
|  |  |  |  | CLEAR FLG |  |  |  |

**IFE0 INTERRUPT ENABLE CONTROL REGISTER 0**: 0x0080

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| - | DMA1IE | AD1IE | U1TXIE | U1RXIE | SPI1IE | SPF1IE | T3IE |
|  | DMA CH1 INT | ADC1 COMPLETE | UART1 Tx REQUEST | UART1 Rx REQUEST | SPI1 INT OCCURRED | SPI1 FAULT INT | TMR3 INT REQUEST |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| T2IE | OC2IE | IC2IE | DMA0IE | T1IE | OC1IE | IC1IE | INT0IE |
| TMR2 INT REQUEST | O/P CMP CH2 INT | I/P CH 2 CAPTURE | DMA CH0 INT | TMR1 INT REQUEST | O/P CMP CH1 INT | I/P CH 1 CAPTURE | EXT TNT CH0 INT |
|  |  |  |  | 1 |  |  |  |
|  |  |  |  | ENABLE |  |  |  |

**IFP0 INTERRUPT PRIORITY CONTROL REGISTER 0**: 0x4000

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| - | T1IP2 | T1IP1 | T1IP0 | - | OC1IP2 | OC1IP1 | OC1IP0 |
|  | TIMER1 INT PRIORITY SELECT | | |  | O/P COMPARE CH1 PRIORITY | | |
|  | 1 | 0 | 0 |  |  |  |  |
|  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| - | IC1IP2 | IC1IP1 | IC1IP0 | - | INT0IP2 | INT0IP1 | INT0IP0 |
|  | I/P CAPTURE CH1 PRIORITY | | |  | EXT INT0 PRIORITY | | |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

**Code Prg02.c**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Source code file: Prg02.c

Author, version, date: PSS ver 1.0 01.11.24

Program function: Timer1 Interrupts RF8 LED1 RF7 LED2 RF6 LED3 RA14 LED4

Simulation: PIC24FJ128GA308 MCU, MPLAB X IDE ver 6.05, XC16 ver 2.10

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

#include <xc.h>

#include <libpic30.h>

uint16\_t dSec**,** sec**,** min**,** hrs**,** day**;**

void initializeDisplayTime **(**void**);**

int main**()**

**{**

initializeDisplayTime**();**

**while** **(**1**);**

**}**

void initializeDisplayTime **(**void**)**

**{**

dSec **=** 0**;**

sec **=** 0**;**

min **=** 0**;**

hrs **=** 0**;**

day **=** 0**;**

TRISA **=** 0x0000**;** // RA14 is set in output mode

TRISF **=** 0x0000**;** // RF6, RF7, RF8 are set in output mode

LATF **=** 0x01C0**;** // Set all LEDs LOW initially

LATA **=** 0x4000**;** // All the LEDS are in common cathode configuration

T1CON **=** 0x8020**;** // TON(1), TCKPS(10): Prescale 1:64, TSIDL(0),

// TGATE(0), TSYNC(0), TIECS(0

TMR1 **=** 0x0000**;** // Tdelay = 0.1 s = (PR1 + 1) \* Prescale \* (2/Fosc)

// = (PR1 + 1) \* 64 \* (2/32 M)

PR1 **=** 2500 **-** 1**;**

IFS0bits**.**T1IF **=** 0**;** // Clear Timer1 interrupt flag

IEC0bits**.**T1IE **=** 1**;** // Enable Timer1 interrupt

IPC0bits**.**T1IP **=** 4**;** // Set Timer1 interrupt priority to the default value of 4

**}**

void \_\_attribute\_\_**((**interrupt**,** no\_auto\_psv**))** \_T1Interrupt**(**void**)**

**{** // Timer1 Interrupt service sub routine

IFS0bits**.**T1IF **=** 0**;** // Clear Timer1 Interrupt Flag T1IF(0)

dSec**++;**

**if** **(**dSec **>** 9**)**

**{**

dSec **=** 0**;**

sec**++;**

**if** **(**sec **%** 2**)**

LATFbits**.**LATF6 **=** 0**;** // LED3 RF6 is turned ON once in two seconds

**else**

LATFbits**.**LATF6 **=** 1**;** // LED3 RF6 is turned OFF

**if** **(**sec **>** 59**)**

**{**

sec **=** 0**;**

min**++;**

**if** **(**min **%** 2**)**

LATFbits**.**LATF7 **=** 0**;** // LED2 RF7 is turned ON once in two minutes

**else**

LATFbits**.**LATF7 **=** 1**;** // LED2 RF7 is turned OFF

**if** **(**min **>** 59**)**

**{**

min **=** 0**;**

hrs**++;**

**if** **(**hrs **%** 2**)**

LATFbits**.**LATF8 **=** 0**;** // LED1 RF8 is turned ON once in two hours

**else**

LATFbits**.**LATF8 **=** 1**;** // LED1 RF8 is turned OFF

**if** **(**hrs **>** 23**)**

**{**

hrs **=** 0**;**

day**++;**

**if** **(**hrs **%** 2**)**

LATAbits**.**LATA14 **=** 0**;** // LED4 RA14 is turned ON once in two days

**else**

LATAbits**.**LATA14 **=** 1**;** // LED4 RA14 is turned OFF

**if** **(**day **>** 30**)** day **=** 0**;**

**}**

**}**

**}**

**}**

**}**