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# CMPE 443 PRINCIPLES OF EMBEDDED SYSTEMS DESIGN

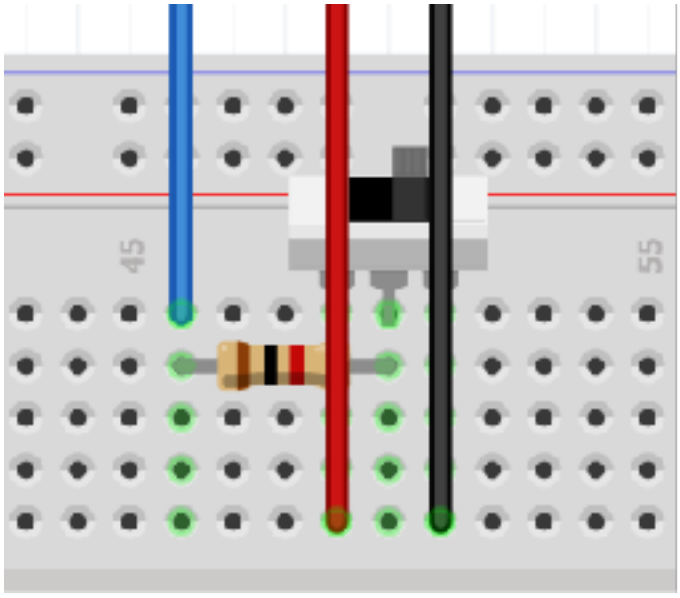
# PRELAB #008 “TIMER”

## 1) Problem Definition

In this prelab, you will use a switch with RGB LED. According to the switching period, you will change the blinking rate of the LED. When the switching period is short, your LED will blink with high frequency, but if the switching period is long, the LED will blink at low frequency.

You will use Timer Interrupt for output compare and input capture.

## 2) Switch




In order to switch between, HIGH and LOW voltage, connect the right side of the switch with GND, left side of the switch with 3.3V, and connect the middle leg of the switch to the related PIN of the board with resistor.

## 3) Timer Input Capture

- Which timer you selected? TIM4
- Which timer channel you selected? TIM4_CH1
- Which pin you selected? PB6
- What is the Alternatif Function value for that pin? AF2
- Configure prescaler to increase the CNT register for every 2 millisecond. (PSC)
  `TIM4->PSC = 7999;`
- Enable capture interrupt? (DIER)
- TIM4->DIER |= 0x01;
- Configure timer channel for input capture. (CCMRx)
  `TIM4->CCMR1 |= 1;`
- Enable input capture. (CCER)) _____
  `TIM4->CCER |= 1;`
- Enable IRQ for Timer
  `NVIC_ISER1 |= (0x01<<15);`
- Write IRQ Handles and Clear interrupts (SR)

```
void TIM4_IRQHandler(void)  // input mode PB6 AF2
{
   static unsigned int ic_pin=LO;
   TIM4->SR = 0;

   if(ic_pin==LO)//HI has come
   {
       ic_pin=HI;
       edgefirst = TIM4->CCR1;

   }
   else //LO has come
   {
       ic_pin=LO;
       pulsewidth= TIM4->CCR1-edgefirst;
       TIM15->CNT = TIM15->CCR1;

   }
}
```

## 4) Timer Output Compare

- Which timer you selected? TIM15
- Which timer channel you selected? TIM15_CH1
- Which pin you selected? PA2
- What is the Alternatif Function value for that pin? AF14
- Configure prescaler to increase the CNT register for every 5 millisecond. (PSC)

```
TIM15->PSC = 19999;
```

- Enable output compare interrupt? (DIER)
- TIM15->DIER |= (0x01<<1);
- Enable main output of the timer. (BDTR)

```
TIM15->BDTR |= 1<<15;
```

- Configure timer channel for output compare and toggle the output. (CCMRx)

```
TIM15->CCMR1 &= ~3;            // select output compare
TIM15->CCMR1 |= 3<<4;          // output toggle
```

- Enable output compare. (CCER))

```
TIM15->CCER  |= 1;
```

- Enable IRQ for Timer

```
NVIC_ISER2 |= (0x01<<5);
```

- Write IRQ Handles and Clear interrupts (SR)

```
void TIM15_IRQHandler(void){ // output mode  PA2 AF14

    TIM15->SR =0;

    TIM15->CCR1 += pulsewidth;
```

## 5) Code

In this prelab, you need to write code as described at the problem definition. LED turn on/off time can change between 100ms - 2000ms according to switching.

## 6) Submission

You will submit one zip file which contains this document and your project (all the files with the last configuration)

The naming of the zip file should be:

PRELAB<exp num>_<StudentID>.zip

## 7) Related Videos and Links

Timer Output Compare:

https://www.youtube.com/watch?v=DQFvV3DJL54

Timer Input Capture:

https://www.youtube.com/watch?v=4qjRQL6MVRo

Timer Input Capture Example Code:

https://embeddedexpert.io/?p=816

Timer Output Compare Example Code:

https://embeddedexpert.io/?p=585