Assignment 2 Embedded System Design

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Write a program in C language to use Capture feature to measure time difference between two consecutive rising edges. To validate this capture logic, you need to generate pulses using GPIO pins. These pulses will become input for the capture (you need to short GPIO pin where you produce output pulse with input pin designated for capture). From the reference manual obtain the information on which pin you need to provide input signal for the capture channel. For the rising edges of this input signals, you will capture the values from TIM3.

1 C PROGRAM:

```
#include "stm32f4xx.h"
int Period;
int Last=0;
float frequency;
int Current =0;
//////////////////////////function prototype//////////////////////////
void generate(void);
void measure(void);

int main(void)
{
        generate();
        measure();

while(1)
{
        while(!(TIM3->SR & (1<<3))){}
                Current= TIM3->CCR3;
                Period = Current-Last;
                Last = Current;
                frequency= 1000.0f /Period ;
}

}
////////////////////////////function for generation of frequency///////
```

```
void generate(void){
        RCC->AHB1ENR |= (1<<0);          /*for PIN PA0=Timer2 channel 1
gpioA    */
        GPIOA->MODER |= 0x00000002 ;
        GPIOA->AFR[0] |= (1<<0);

        RCC->APB1ENR |= 1<<0;    /*Tim2 clock enabled */
        TIM2->PSC = 16000-1;    /* 16MHZ/16000    */
        TIM2->ARR = 50 -1;          /* 1000/50 = 20hz frequency
*/

        TIM2->CCMR1 = (3<<4);
        TIM2->CCR1 = 0 ;
        TIM2->CCER |= (1<<0);

        TIM2->CNT=0 ;
        TIM2->CR1 |= (1<<0);  /* Enable Counter*/
}
////////////////////////////function for measurement of frequency///////
void measure(void){
        RCC->AHB1ENR |= 1U<<1;   //for gpio B ( PB0 pin TIM3 channel 3 )
        GPIOB->MODER |= 0x00000002; // Set PB0 to alternate function mode
        GPIOB->AFR[0] |= (1<<1);   //setting AF1 pin high

        RCC->APB1ENR |= 1<<1;        //Timer 3 clock enabled

        TIM3->PSC = 16000-1;     //16MHZ/16000 =1000
        TIM3->CCMR2 |= (1<<0);  //    for Channel 3
        TIM3->CCMR2 |= 1<<6;
        TIM3->CCER |=0x0B00;
        TIM3->CR1 = 1<<0 ;      //enable counter
}
```

2 IMPLEMENTATION ON NUCLEO144 BOARD WITH STM32F412ZGT6

Here: Using Timer3 channel 3

$$\text{Clock frequency} = 16\,\text{MHz}$$
$$\text{PSC} = 16000$$
$$\text{ARR} = 50$$

Since the output frequency is given by:

$$\text{Output Frequency} = \frac{\text{Input clk}}{(PSC+1)\times(ARR+1)}$$

Therefore, the output frequency is:

$$\text{Output Frequency} = \frac{16\,\text{MHz}}{(16000+1)\times(50+1)} = 20\,\text{Hz}$$

Can be verified from the Watch window of the Keil=20hz

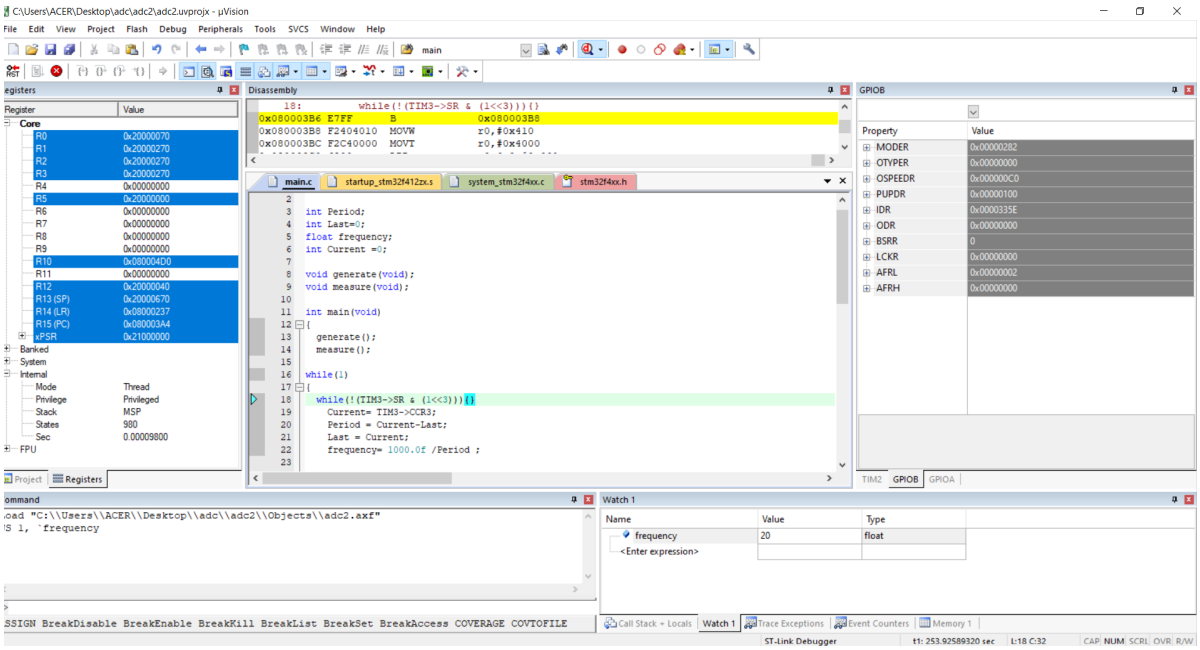

Figure 1: KEIL DEBUGGER MODE

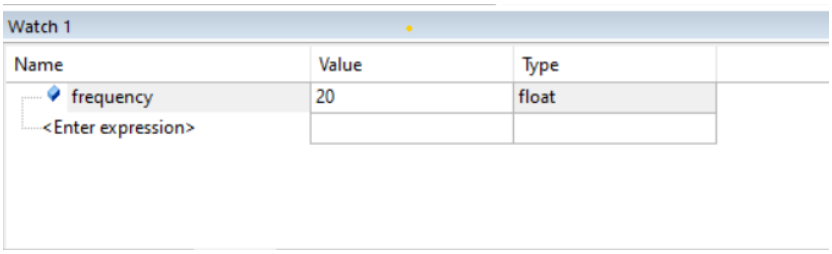

Figure 2: Watch window

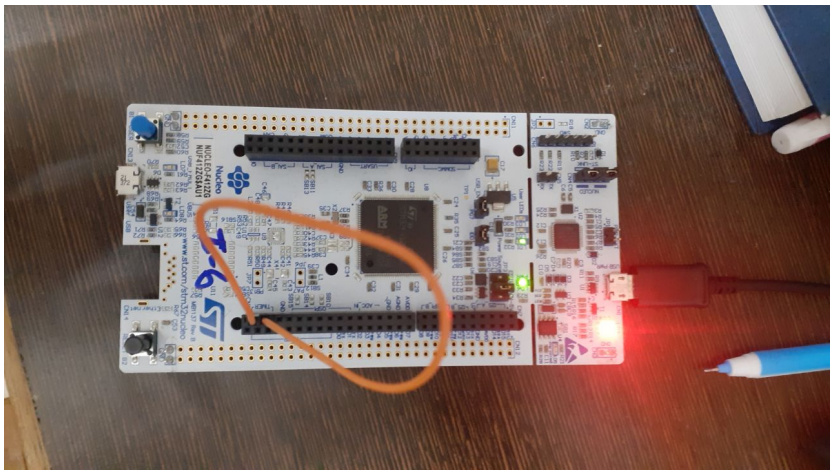

Figure 3: Setup

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