

# Assignment 1 Embedded System Design

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The processor comes with internal temperature sensor. The temperature sensor can be used to measure the ambient temperature (TA) of the device. The internal temperature sensor is connected to ADC1\_IN18 channel. Write a program in C language to read this internal temperature sensor connected to ADC1\_IN18 internally.

## 1 C PROGRAM:

```
#include "stm32f4xx.h"
#define Avg_Slope 0.0025
#define V25 0.76

int main(void)
{
    volatile float vsense;
    volatile uint32_t temp;
    volatile float temp_celsius;

    RCC->APB2ENR |= 0x100; /* //enable clock for ADC1*/
    ADC1->SQR3 |= (1U << 4); /* 1st conversion in regular sequence */
    ADC1->SQR1 = 0x00; /* conversion length 1 sequence */
    ADC->CCR |= ADC_CCR_TSVREFE; /* temperature sensor activate */
    ADC1->CR2 |= ADC_CR2_ADON; /* enable ADC conversion */

    ADC1->CR2 |= 1U << 1; /* enable continuous conversion */
    ADC1->CR2 |= 0x40000000; /* start the ADC conversion */

    while (1)
    {
        while (!(ADC1->SR & ADC_SR_EOC)) {}
        /* wait for end of conversion */
        temp = ADC1->DR;
        vsense = ((float)temp / 4095) * 3.3; /* typical Vdd=3.3V
, RESOLUTION = 12BIT*/
        temp_celsius = ((vsense - V25) / Avg_Slope) + 25;
```

```

    }
}

```

## 2 IMPLEMENTATION ON NUCLEO144 BOARD WITH STM32F412ZGT6

Temperature (in C) =  $\left( \frac{V_{SENSE} - V_{25}}{Avg\_Slope} \right) + 25$

$Avg\_Slope = 0.0025V/C$ ,  $V_{25} = 0.76V$ ,  $V_{SENSE} = \left( \frac{DATA}{4095} \right) \cdot V_{DD}$   
therefore, Temperature (in C) = 31.739

Can be verified from the Register value of temp\_celsius below

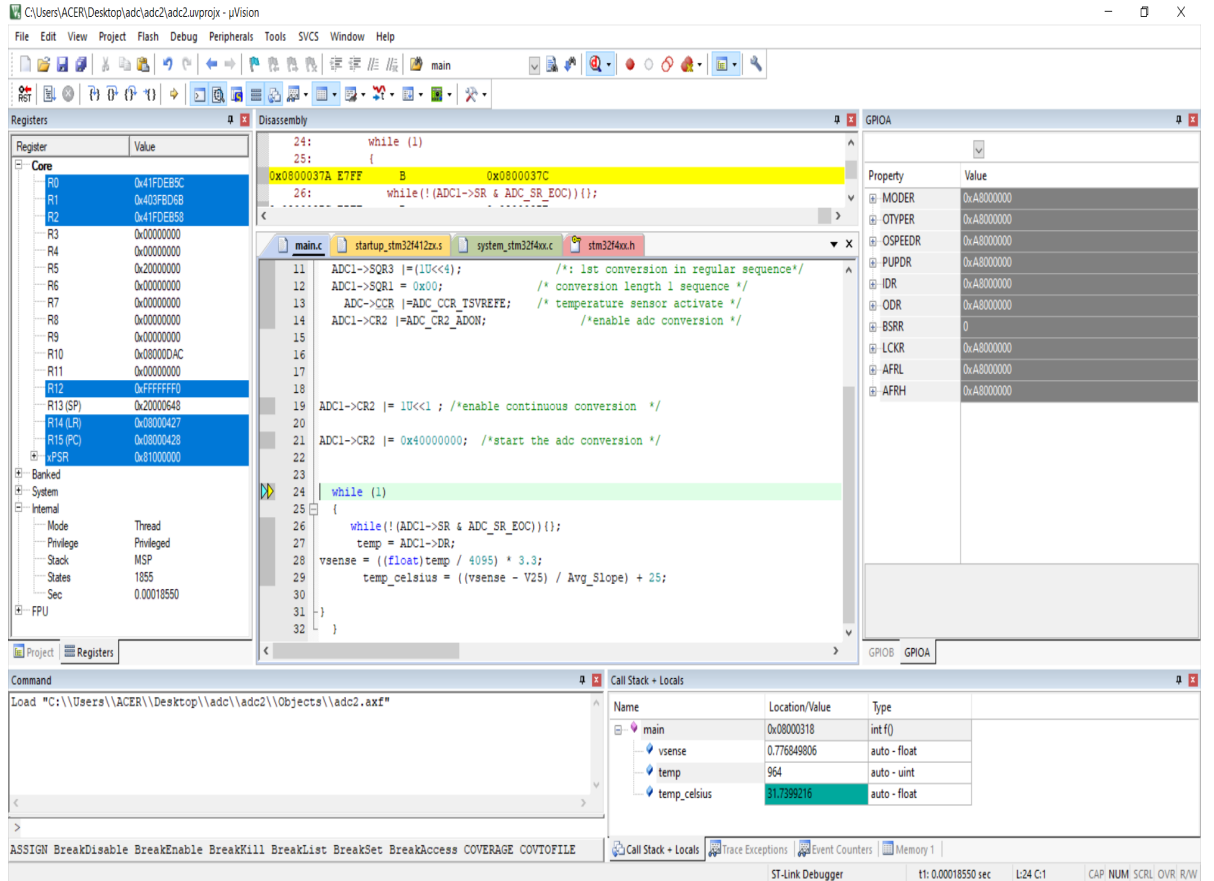


Figure 1: KEIL DEBUGGER MODE

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