Development of ADC Acquisition System Based on STM32

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Abstract. This paper describes the method and principle of ADC acquisition by STM32. The hardware circuit is designed and built the experimental platform. In order to make the measured value accurate and reliable. The data were sampled for 200 times, and the data were sorted. Removed the maximum’s forty value and the minimum’s forty value, with the remaining 120 data to sum, and calculate the average value to get the final acquisition value. This mean filtering algorithm can effectively remove interference. The test results show that the design can accurately sample the external voltage value, and has certain practical value.

Introduction

In practical applications, we often use a variety of sensors to detect external signals. Sensor signals are relatively weak, to be amplified, filtered, input to the microprocessor. The microprocessor samples the analog input and converts it into a digital value. In the acquisition process, due to the existence of a variety of interference signals. Therefore, the software must be filtered, in order to make the collected value accurate and reliable. Commonly used software filtering algorithm average filtering algorithm, Calman filtering algorithm, etc. Average filtering algorithm is the most simple and feasible.

In this paper, the high performance microprocessor STM32 is used to realize the acquisition of external input analog voltage, and the result can be converted to 12 bit digital. The average filter algorithm is introduced to make the results more accurate and reliable.

The Principle of ADC Sample

The STM32 pin diagram is shown in figure 1. Pin PA0, PA1, PA2, PA3, PA5, PA4, PA6, PA7, PB0, PB1, PC0, PC1, PC2, PC3, PC4, PC5 is the external input pin ADC. Each pin can be connected to an external input analog. Select a single channel for ADC acquisition, you can choose multi-channel ADC acquisition.

Figure 2 shows a sliding rheostat with one end connected to the +3.3V voltage and the other end grounded. When the center tap is sliding, it will output a variable voltage value, the voltage range from 0V to 3.3V. will be connected to the STM32’s on any AD acquisition pin to sample of the analog voltage.
Software Program

In this design, in KEIL 5 use the C language programming. Function Adc1_Init (void) to complete the initialization of the acquisition of ADC, and then call the software filtering function for the acquisition of data processing. The following part of the code:

```c
Void Adc1_Init(void)
{
    RCC->APB2ENR|=1<<3;
    RCC->APB2ENR|=1<<4;
    GPIOC->CRL&=0XFF000000;
    RCC->APB2ENR|=1<<10;
    RCC->APB2RSTR|=1<<10;
    RCC->APB2RSTR&=~(1<<10);
    RCC->CFGR&=~(3<<14);
    RCC->CFGR|=2<<14;
}  
```

Figure 1. The pin of STM32.

Figure 2. AD sample.
ADC2->CR1&=0XF0FFFF;
ADC2->CR1|=0<<16;
ADC2->CR1|=(1<<8);
ADC2->CR2|=1<<8;
ADC2->CR2|=(1<<1);
ADC2->CR2&=-(7<<17);
ADC2->CR2|=1<<20;
ADC2->CR2&=-(1<<11);
ADC2->SQR1&=-(0XF<<20);
ADC2->SQR1|=1<<20;
ADC2->SMPR2&=-(7<<24);
ADC2->SMPR2|=7<<24;
ADC2->SMPR2&=-(7<<27);
ADC2->SMPR2|=7<<27;
ADC2->CR2|=1<<0;
ADC2->CR2|=1<<3;
while(ADC2->CR2&1<<3);
ADC2->CR2|=1<<2;
while(ADC2->CR2&1<<2);
MY_NVIC_Init(2,2,ADC1_2_IRQChannel,2);

Summary
This paper describes the working principle of ADC acquisition using STM32, and designs the hardware circuit and programs the software. In the program, the ADC is initialized, and the average filter is used to reduce the interference. The test results show that the design can accurately measure the analog voltage value, it has certain practical value.

Reference