

## Design of Automatic Patrolling Trolley Based on CCD

Jian Huang

XiJing University, Xi'an 710123, China;

565200245@qq.com

**Keywords:** Intelligent vehicle; Photo electric sensor; CCD

**Abstract.** In the research of intelligent vehicle tracking, more early is the application of photoelectric sensor, photoelectric sensor due to natural light, so the effect is poor. In order to improve the effect of using CCD, linear tracking, 128 dot detection algorithm to find the median black line, with the center point. Then calculate the offset of the car relative to the center point, and control the left turn, right turn and straight line of the car according to the offset. The test results show that this design has higher tracking precision, strong anti-interference ability, has certain practical value.

### Introduction

In recent years, intelligent vehicle tracking technology has been greatly improved, from the early development of the CCD photoelectric sensor array tracking, CCD linear array is in linear uniform distribution of 128 photodiodes, each pixel spacing is 8 microns, each pixel can output 256 gray level. Therefore, the acquisition of a greater amount of information, the color recognition ability, suitable for tracking of black and white line track.

### Hardware Circuit Design

#### Motor Drive Circuit Design

The motor drive circuit is shown in figure 1. The motor drive adopts TB6612, TB6612 is the high performance motor driver chip, the peak current is up to 2A, especially suitable for driving small DC motors. In figure PD12, PF13 output, PF14 control of 1 motor rotation direction, PF13, PF14 to control the motor, PD12 motor speed control; PD13, PF15, PG0 and 1 output control motor rotation direction, PF15, PG0 to control the motor, PD13 motor speed control;

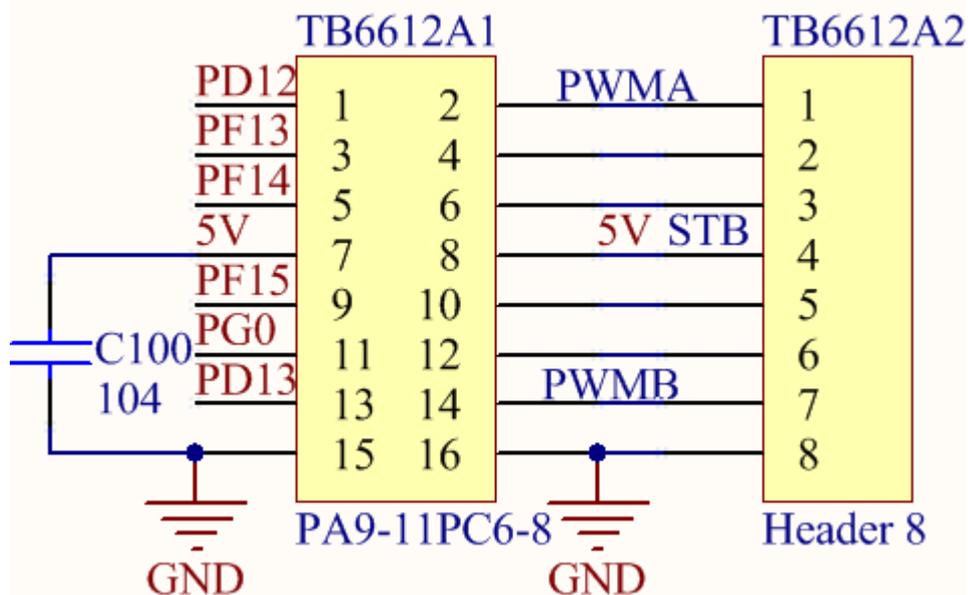


Figure 1. TB6612 motor drive circuit diagram

#### Linear CCD Principle

The sensor is a linear array of 128 photodiodes, which generate photocurrent under the

irradiation of light. Can continuously output 128 pixel voltage values, through the STM32 A/D acquisition pin for acquisition and processing.

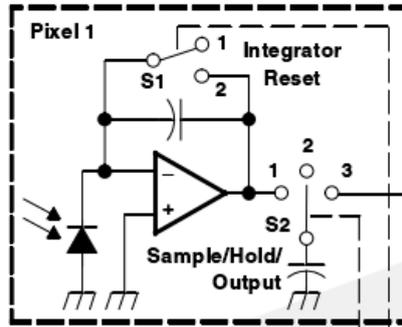


Figure 2. Schematic diagram of photodiode integration

### Software Programming

In this design, under KEIL 5, programming with C language. CCD data acquisition, the realization of the median algorithm. Some code is given below:

```
void RD_TSL(void)
{
    u8 i=0,tslp=0;
    TSL_CLK=1;
    TSL_SI=0;
    Dly_us();
    TSL_SI=1;
    TSL_CLK=0;
    Dly_us();
    TSL_CLK=1;
    TSL_SI=0;
    Dly_us();
    for(i=0;i<128;i++)
    {
        TSL_CLK=0;
        Dly_us();
        ADV[tslp]=(Get_Adc(3))>>4;
        ++tslp;
        TSL_CLK=1;
        Dly_us();
    }
}
u16 Get_Adc_Average(u8 ch,u8 times)
{
    u32 temp_val=0;
    u8 t;
    for(t=0;t<times;t++)
    {
        temp_val+=Get_Adc(ch);
        delay_us(200);
    }
    return temp_val/times;
}
u16 Get_Adc(u8 ch)
{
```

```
ADC1->SQR3&=0XFFFFFFE0;  
ADC1->SQR3|=ch;  
ADC1->CR2|=1<<22;  
while(!(ADC1->SR&1<<1));  
return ADC1->DR;  
}
```

## Summary

This paper expounds the principle and realization method of automatic tracking by linear CCD, realized the hardware circuit design using CCD sensor, TB6612 module etc.. Software programming is carried out under KEIL to realize the recognition of black and white lines. And find the center point of the line with the median algorithm, the control of the car forward, turn left, turn right, to realize the automatic tracking function, has a certain practical value.

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