

CCD tracking

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- Hardware connection
- Control principle
- Main code
- Program flow chart
- Experimental phenomenon

The tutorial mainly demonstrates the line patrol function of the balance car combined with the linear CCD module.

The tutorial only introduces the standard library engineering code

Hardware connection

Peripherals	Development board
CCD: VCC	3.3V
CCD: AO	PA4
CCD: SLK	PB4
CCD: SI	PB5
CCD: GND	GND

Control principle

The program determines the center pixel position of the black line detected by the CCD line patrol module, and compares this center pixel position with the preset CCD median value as the PID control error of the CCD line patrol.

Use dynamic threshold algorithm to eliminate the impact of ambient light on CCD camera

- CCD module



Peripherals	Description
CCD: VCC	Power supply pin: 3.3V-5V
CCD: AO	Gray value output pin: analog output
CCD: CLK	Clock pin, determines exposure time and controls the output of pixel gray value.
CCD: SI	Controls the acquisition and output of pixel gray value.
CCD: GND	Power supply pin: GND

Black line detected

The corresponding grayscale value is low;

White line detected

The corresponding grayscale value is high

Main code

The tutorial mainly explains the code for the CCD line patrol function. For detailed code, refer to the corresponding project file.

Turn_CCD_PD

If the line patrol effect of the balance car is not good, modify the PID parameters of the app_ccd_tracking.c file. It is not recommended to modify the PID parameters of the pid_control.c file (the PID parameters of the pid_control.c file are subject to the parameters finally confirmed by the balance car parameter adjustment tutorial).

```
int Turn_CCD_PD(float gyro)
{
    int CCDTurn = 0;
    float err = 0;

    err=CCD_Zhongzhi-CCD_Minddle;

    CCDTurn=err*CCD_Trunc_KP+gyro*CCD_Trunc_KD;

    return CCDTurn;
}
```

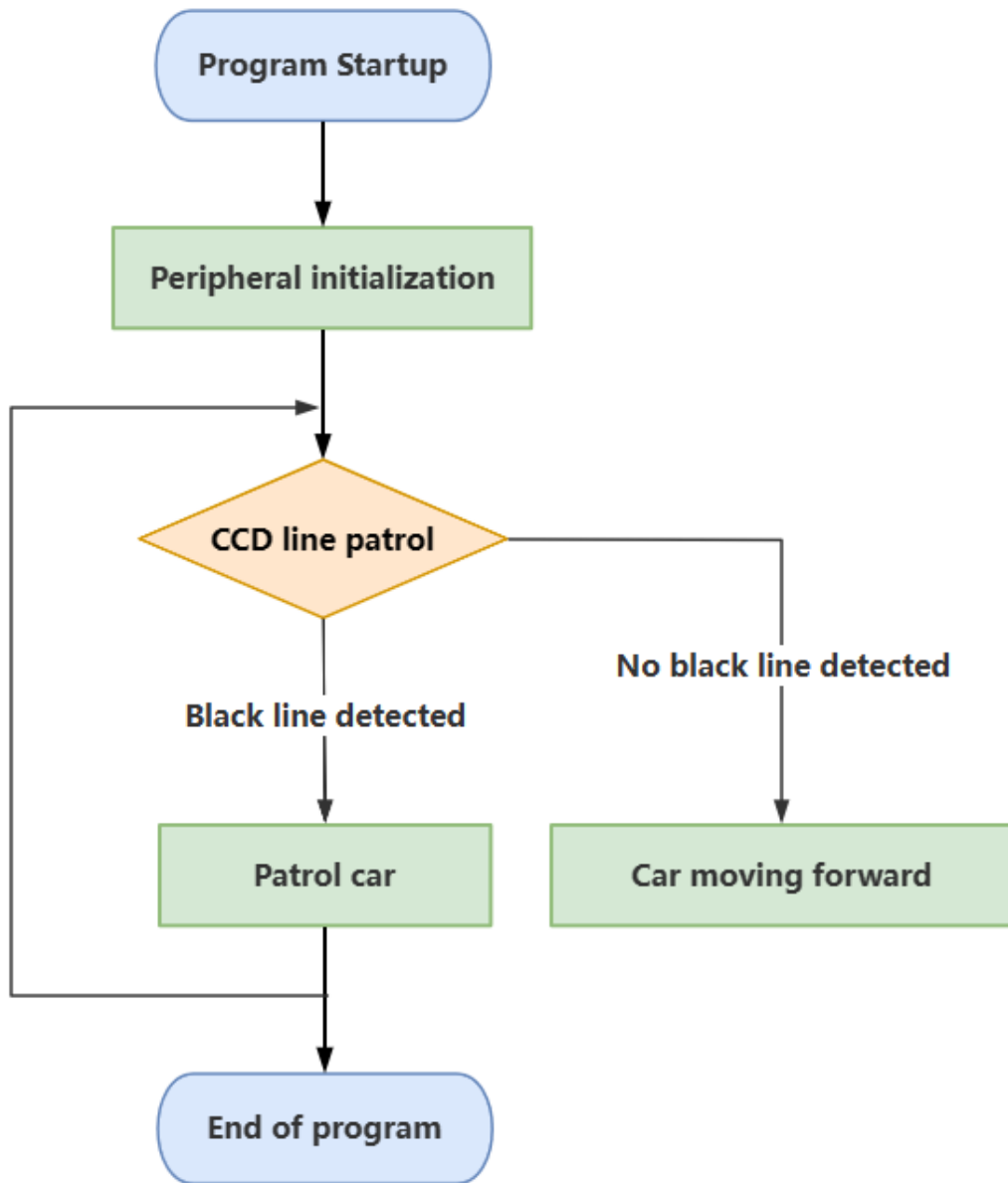
Set_track_speed

Set the speed of the car.

```
void Set_track_speed(void)
{
    Move_X = Track_Speed;
}
```

Program flow chart

Briefly introduce the process of function implementation:



Experimental phenomenon

Software code

The CCD_Car_Line.hex file generated by the project compilation is located in the OBJ folder of the CCD_Car_Line project. Find the CCD_Car_Line.hex file corresponding to the project and use the FlyMcu software to download the program into the development board.

Product supporting materials source code path: Attachment → Source code summary → 5.Balanced_Car_Extended → 04.CCD_Car_Line

Experimental phenomenon

After the program is started, put the car on the patrol map, and press KEY1 according to the OLED prompt to start the CCD patrol function of the balance car: OLED displays CCD module data in real time in the form of a curve!

The program has voltage detection. If the voltage is less than 9.6V, the low voltage alarm is triggered and the buzzer will sound.

Common situations for triggering voltage alarms:

1. The power switch of the development board is not turned on, and only the Type-C data cable is connected for power supply
2. The battery pack voltage is lower than 9.6V and needs to be charged in time