

4-channel tracking avoid

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The tutorial mainly demonstrates the line patrol and obstacle avoidance function of the balancing car combined with the four-way tracking module and the ultrasonic module.

The tutorial only introduces the standard library project code

Hardware connection

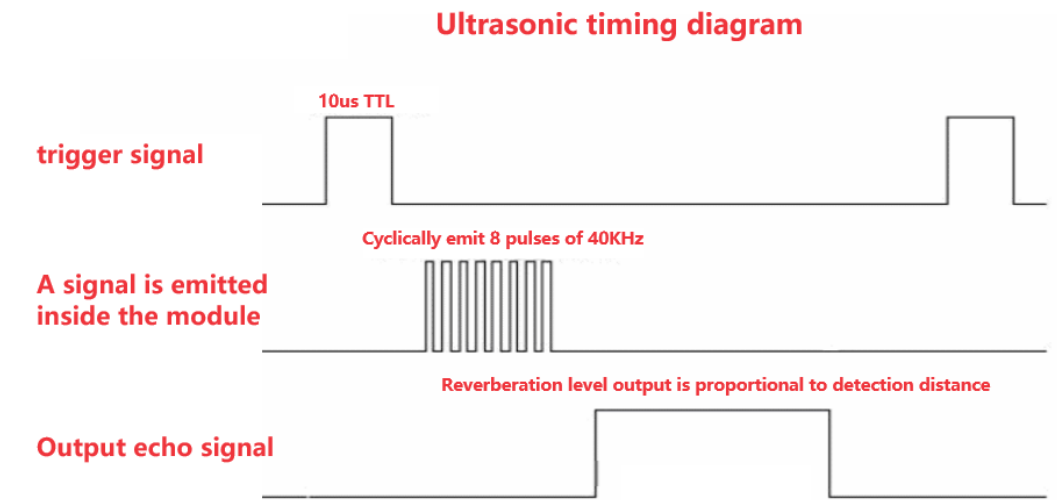
Ultrasonic module	STM32F103RCT6
VCC	5V
TRIG	PA0
ECHO	PA1
GND	GND

LED corresponding to the four-way patrol module	Four-way patrol module	Development board
	VCC	5V/3.3V
L1	X1	PC4
L2	X2	PC5
L3	X3	PB0
L4	X4	PB1
	GND	GND

Control principle

Ultrasonic module

The ultrasonic module is mainly responsible for obtaining the distance between the obstacle and the car to achieve the obstacle avoidance function.



Trigger ranging signal

The TRIG pin sends a high-level signal for more than 10us.

The ultrasonic module will automatically send 8 40KHz square waves and automatically detect whether there is a signal return

Receive echo signal

If there is a signal return, the ECHO pin outputs a high level, and the duration of the high level is the time from the ultrasonic wave to the return.

Distance conversion

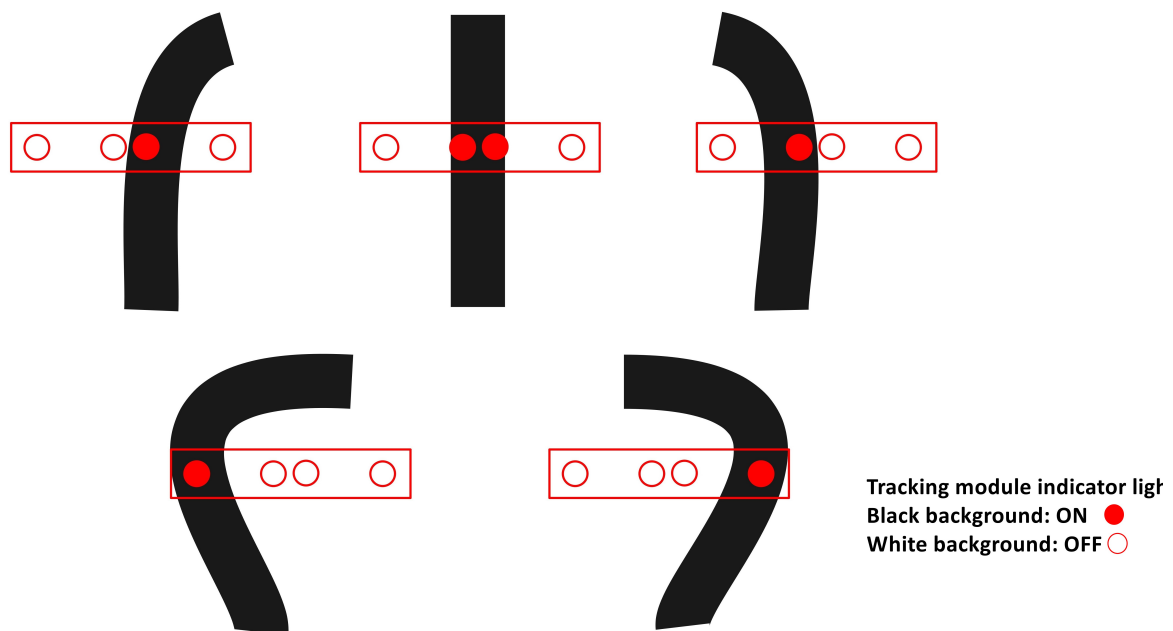
$$D_{istance} = \frac{T_{high} * V_{speed}}{2}$$

T: high level time of echo signal
v: sound speed (approximately equal to 340m/s)

Four-way line patrol module

By reading the X1, X2, X3, and X4 interface levels of the four-way tracking module, it is determined whether the black line is detected and where the black line is located.

The program uses PID to implement the line patrol function. If the PID parameters are not used, the effect is poor



Black line detected

The light is on → the corresponding interface of the four-way line patrol module outputs a low level;

White line detected

The light is off → the corresponding interface of the four-way line patrol module outputs a high level.

Note: The corresponding relationship between the interface, LED, and adjustment knob shall be based on the silkscreen numbers, for example: X1 corresponds to L1, SW1

Main code

The tutorial mainly explains the code for the four-way patrol and obstacle avoidance function. For detailed code, please refer to the corresponding project file.

Turn_IRTrack_PD

Four-way patrol and obstacle avoidance adds ultrasonic distance judgment on the basis of four-way patrol. The car stops when there is an obstacle in front.

If the patrol effect of the balance car is not good, modify the PID parameters of the app_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 in the balance car parameter adjustment tutorial).

```
int Turn_IRTrack_PD(float gyro)
{
    int IRTrackTurn = 0;
    float err = 0;
    static float IRTrack_Integral;

    if (g_distance < STOP_Dis && g_distance>0) // There are obstacles ahead
    {
```

```

        return 0;
    }

    PID_track_get(); // Obtain deviation

    err=error-IRTrack_Minddle;

    IRTrack_Integral +=err;

    IRTrackTurn=err*IRTrack_Trun_KP+IRTrack_Trun_KI*IRTrack_Integral+gyro*IRTrack_Trun_KD;

    return IRTrackTurn;
}

```

Set_track_speed

```

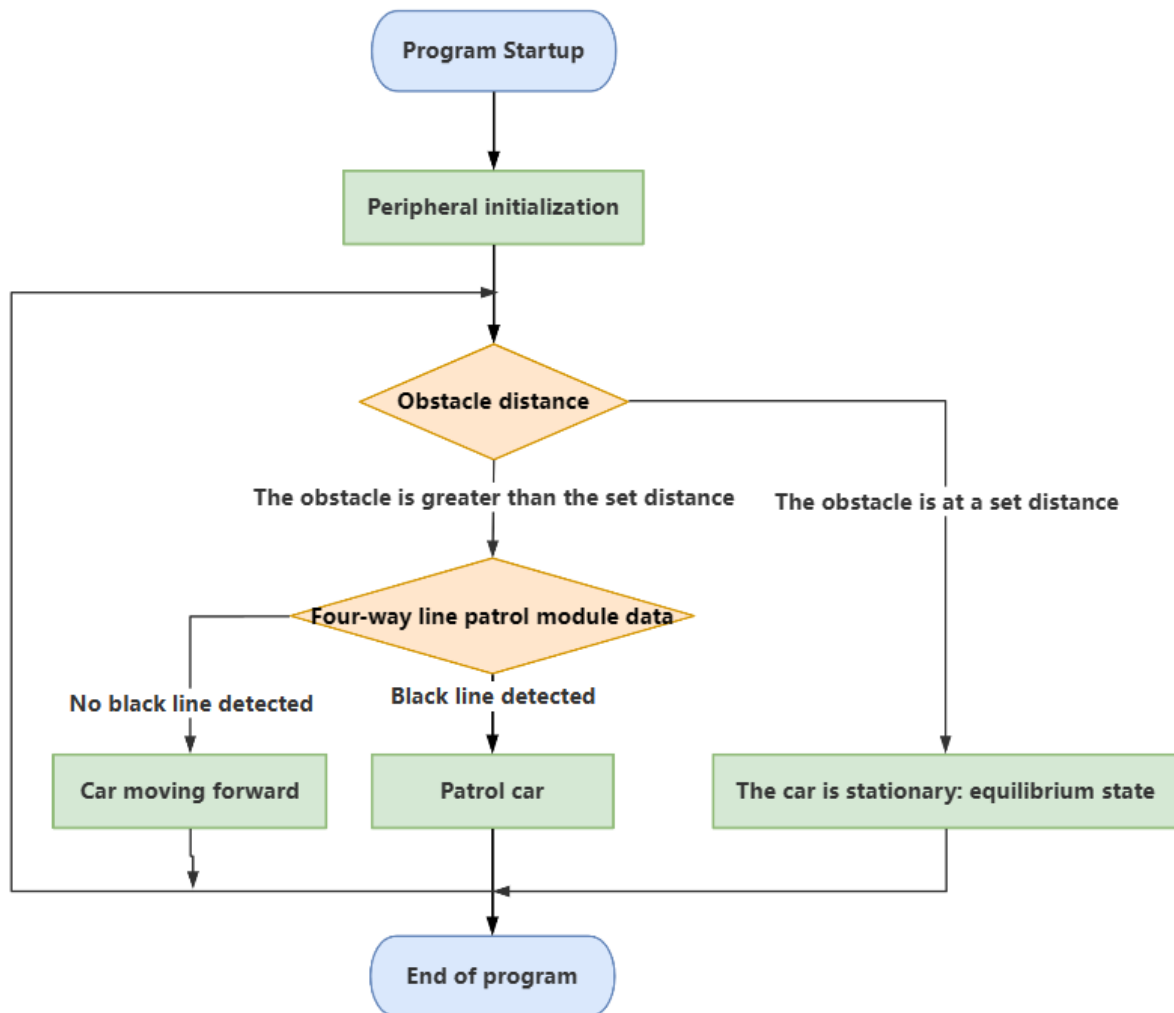
void Set_track_speed(void)
{
    if (g_distance < STOP_Dis && g_distance>0)
    {
        Move_X = 0;// stop car
        if(battery > 9.6)// Sufficient voltage
            BEEP_BEEP = 1;
        return;
    }

    if(battery > 9.6)// Sufficient voltage
        BEEP_BEEP = 0;
    Move_X = Track_Speed;
}

```

Program flow chart

Briefly introduce the process of function implementation:



Experimental phenomenon

Software code

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

Product supporting data source code path: Attachment → Source code summary → 5.Balanced_Car_Extended → 02.BalancedCar_tracking_Stop

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 balanced car patrol function: OLED will display the deviation setting value and the level of the four-way patrol module in real time. When the ultrasonic wave detects an obstacle, it will sound a buzzer and stop moving to maintain balance.

The program has voltage detection. If the voltage is less than 9.6V, a low voltage alarm will be 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