Lidar avoid

The tutorial mainly demonstrates the obstacle avoidance function of the balance car combined with the Tmini-Plus radar.

```
The tutorial only introduces the standard library project code
```

Hardware connection

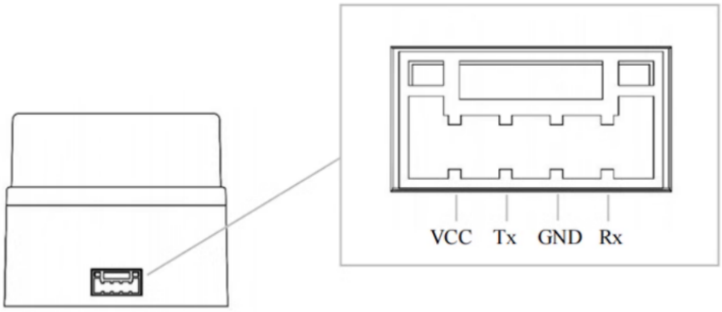
Since we have configured a special connection line, we only need to install it to the corresponding interface.

Peripherals	Development Board
Tmini-Plus radar: VCC	5V
Tmini-Plus radar: TXD	PC10
Tmini-Plus radar: RXD	PC11
Tmini-Plus radar: GND	GND

Control principle

The program analyzes the radar data and determines the movement direction of the balance car based on the distance information at the specified angle.

- Tmini-Plus radar

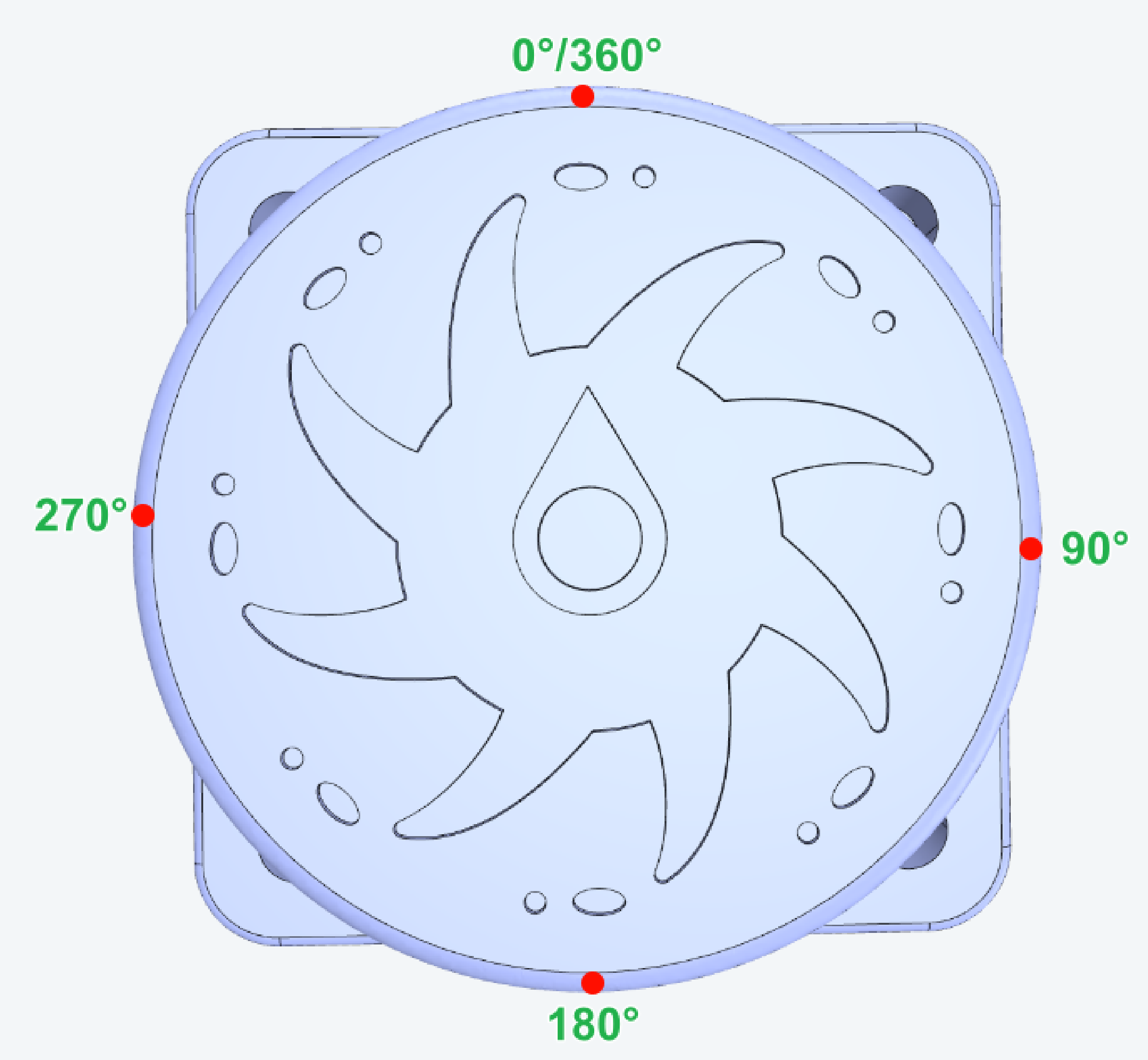


Product name	Tmini-Plus radar
Scanning frequency	6-12Hz
Sampling frequency	4000 times/s

Product name	Tmini-Plus radar
Measuring radius	Black object: 12m
Minimum measuring distance	0.05m
Ranging principle	TOF ranging
Scanning angle	360°
Communication interface	Standard asynchronous serial port (UART) 1. Baud rate: 230400 2. Data bits: 8 3. Check bit: None 4. Stop bit: 1
ROS support	ROS1/ROS2
Windows support	Host computer

Radar angle distribution

The arrow in the center of the radar points to 0°/360°, and the angle increases clockwise.



Communication protocol

```
For detailed information, please refer to the "T_Mini_Plus Manual"
```

Main code

The tutorial mainly explains the code for implementing the radar obstacle avoidance function. For detailed code, please refer to the corresponding project file.

> **Car_Avoid**

The obstacle position of the balance car is determined through the radar's 0°, 90°, and 270° distance data and the movement of the balance car is controlled.

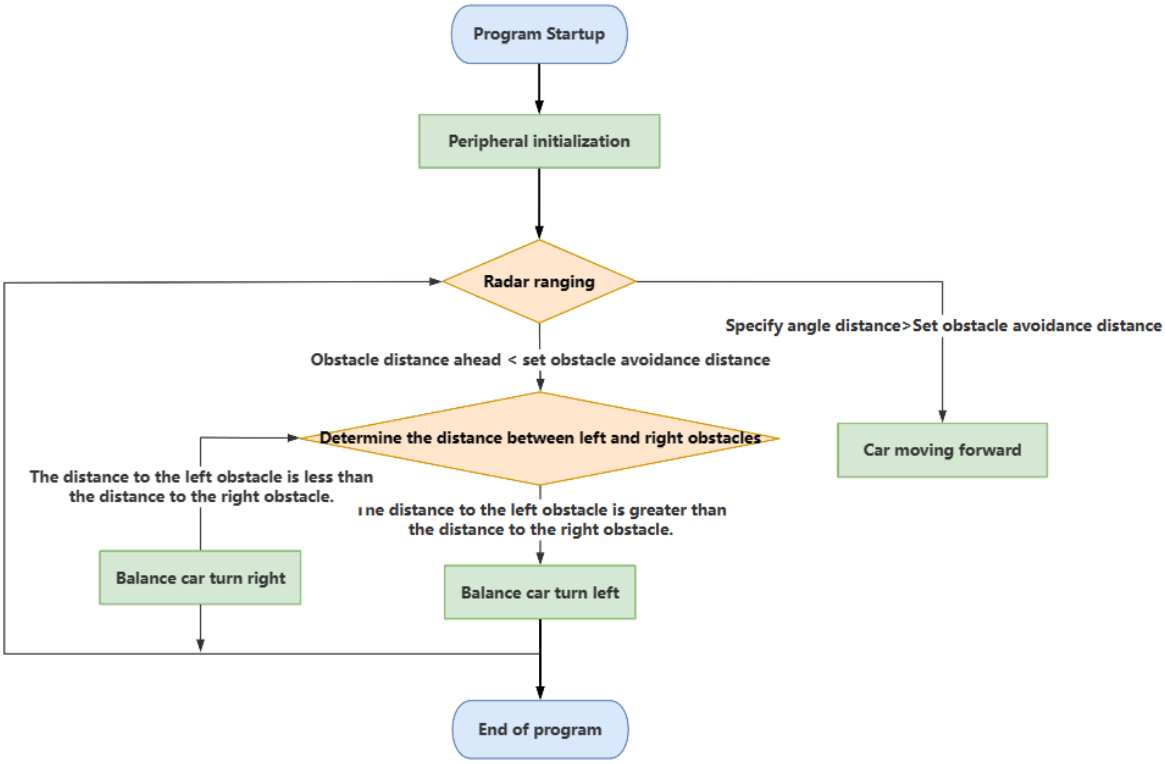
```
void Car_Avoid(void)
{
    static u8 avoid_step = 0;// Obstacle Avoidance Steps

    // Each time this function is called, the value is dynamically refreshed.
    float get_data_mid = Tminidis[0];
    float get_data_Lmid = Tminidis[270];// Left
    float get_data_Rmid = Tminidis[90];// Right

    switch(avoid_step)
    {
        case 0:
        if(get_data_mid <avoid_dis && get_data_mid >0 )//  Obstacle Avoidance
        {
            // Car stop
            Move_X = 0,Move_Z = 0;
            delay_time_int(10);
            avoid_step = 1;
        }
        else
        {
            // Car moving forward
            Move_X = GO_speed,Move_Z = 0;
        }
        break;
        case 1: if(get_time_int()==0) avoid_step ++;break; // Time to go to next
step
        case 2:
        {
            // Trolley backward
            Move_X = -15,Move_Z = 0;
            delay_time_int(100); //1s
            avoid_step = 3;
        }
        case 3: if(get_time_int()==0) avoid_step ++;break; // Time to go to next
step
        case 4:
        {
            if(get_data_Lmid >= get_data_Rmid )
            {
                // left
                Move_X = 0,Move_Z = -450;
                delay_time_int(100);
            }
            else
            {
                // right
                Move_X = 0,Move_Z = 450;
                delay_time_int(100);
            }
            avoid_step = 5;
        }
        case 5: if(get_time_int()==0) avoid_step=0;break; // Time to go to next
step
    }
}
```

Program flow chart

Briefly introduce the process of function implementation:


Program Startup
Peripheral initialization
Radar ranging
Specify angle distance>Set obstacle avoidance distance
Obstacle distance ahead < set obstacle avoidance distance
Determine the distance between left and right obstacles
Car moving forward
The distance to the left obstacle is less than the distance to the right obstacle.
ıne distance to the left obstacle is greater than the distance to the right obstacle.
Balance car turn right
Balance car turn left
End of program

Experimental phenomenon

> ### Software code

The Balance_Radar_Avoid.hex file generated by the project compilation is located in the OBJ folder of the Balance_Radar_Avoid project. Find the Balance_Radar_Avoid.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 → 12.Balance_Radar_Avoid
```

> ### Experimental phenomenon

After the program is started, press KEY1 according to the OLED prompt to start the radar obstacle avoidance function of the balance car: OLED displays start control!

Radar does not detect obstacles (obstacle distance>200mm): the car moves forward

Radar detects obstacles in front (0mm<obstacle distance<200mm): the car stops and moves backward

Judge the distance between left and right obstacles:

Left obstacle distance ≥ right obstacle distance: the car turns left and then moves forward

Left obstacle distance <right obstacle distance: the car turns right and then moves forward

```
The program has voltage detection. If the voltage is less than 9.6V, a low voltage alarm is triggered and the buzzer will sound.
Common situations that trigger 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
```