Ultrasonic obstacle avoidance

This tutorial is a comprehensive experiment combining multiple peripherals. You can first understand a single peripheral before performing this experiment.

1. Software-Hardware

- **STM32F103CubeIDE**

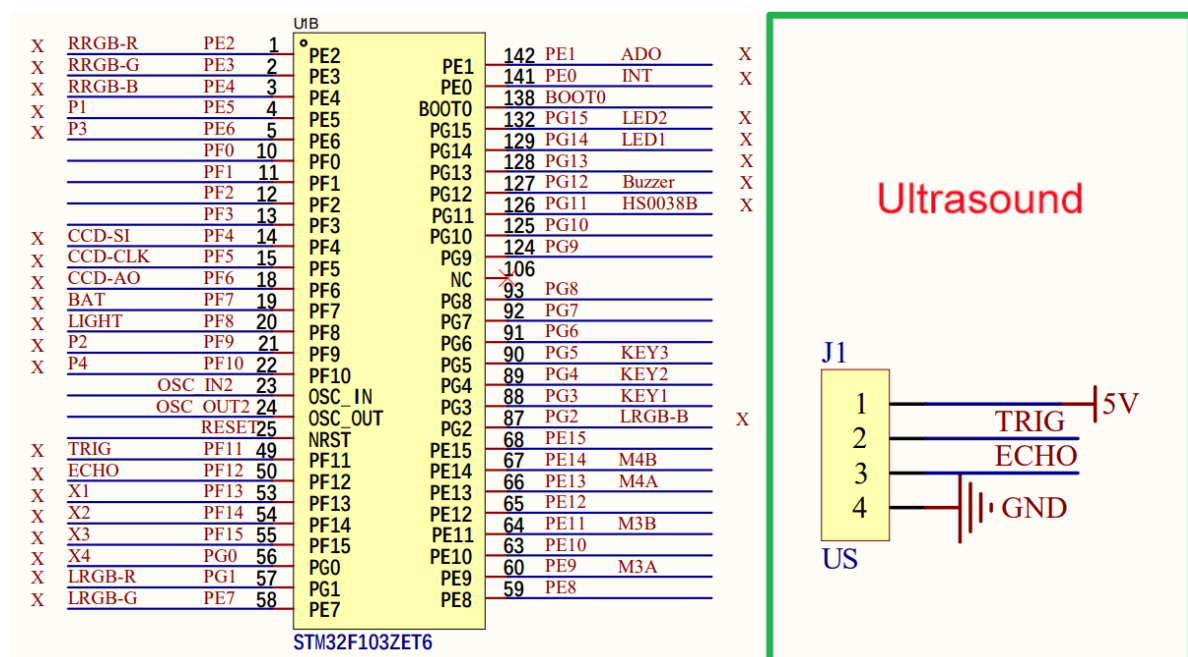- **STM32 Robot Development Board**

  Ultrasonic module, 310 motor*4: external

- **Type-C data cable or ST-Link**

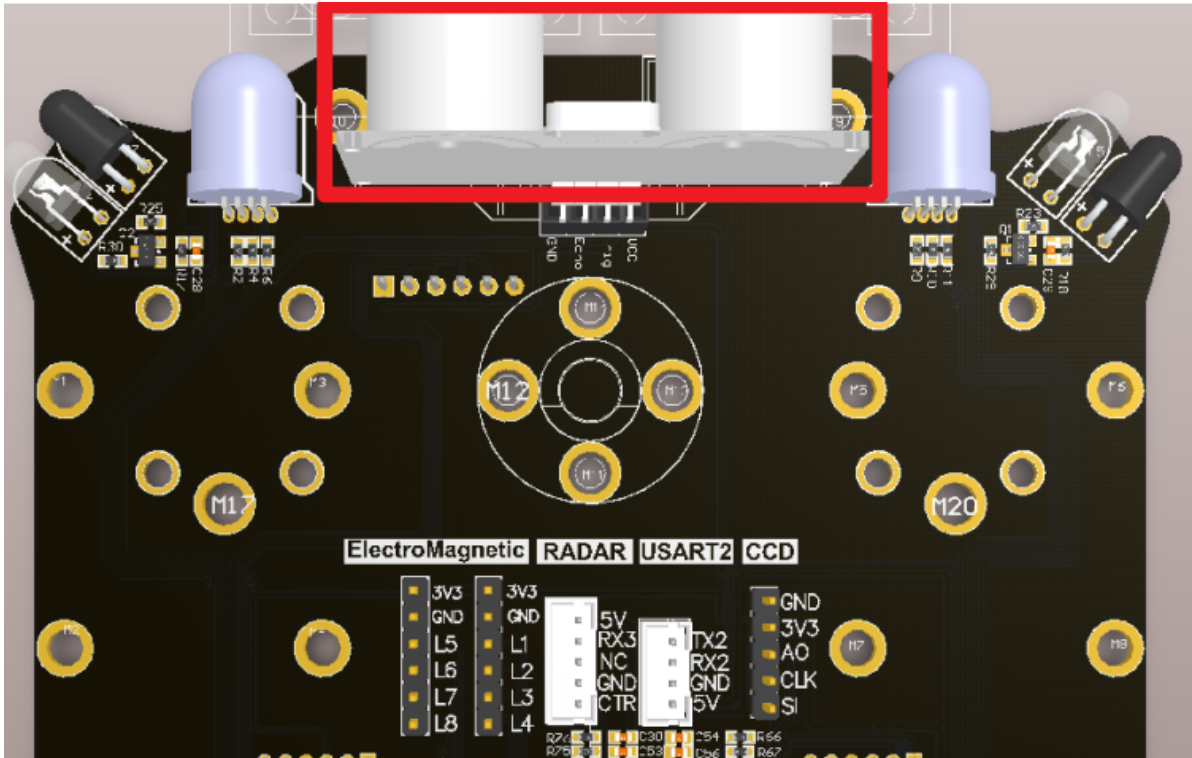 Download programs or simulate the development board

2. Brief principle
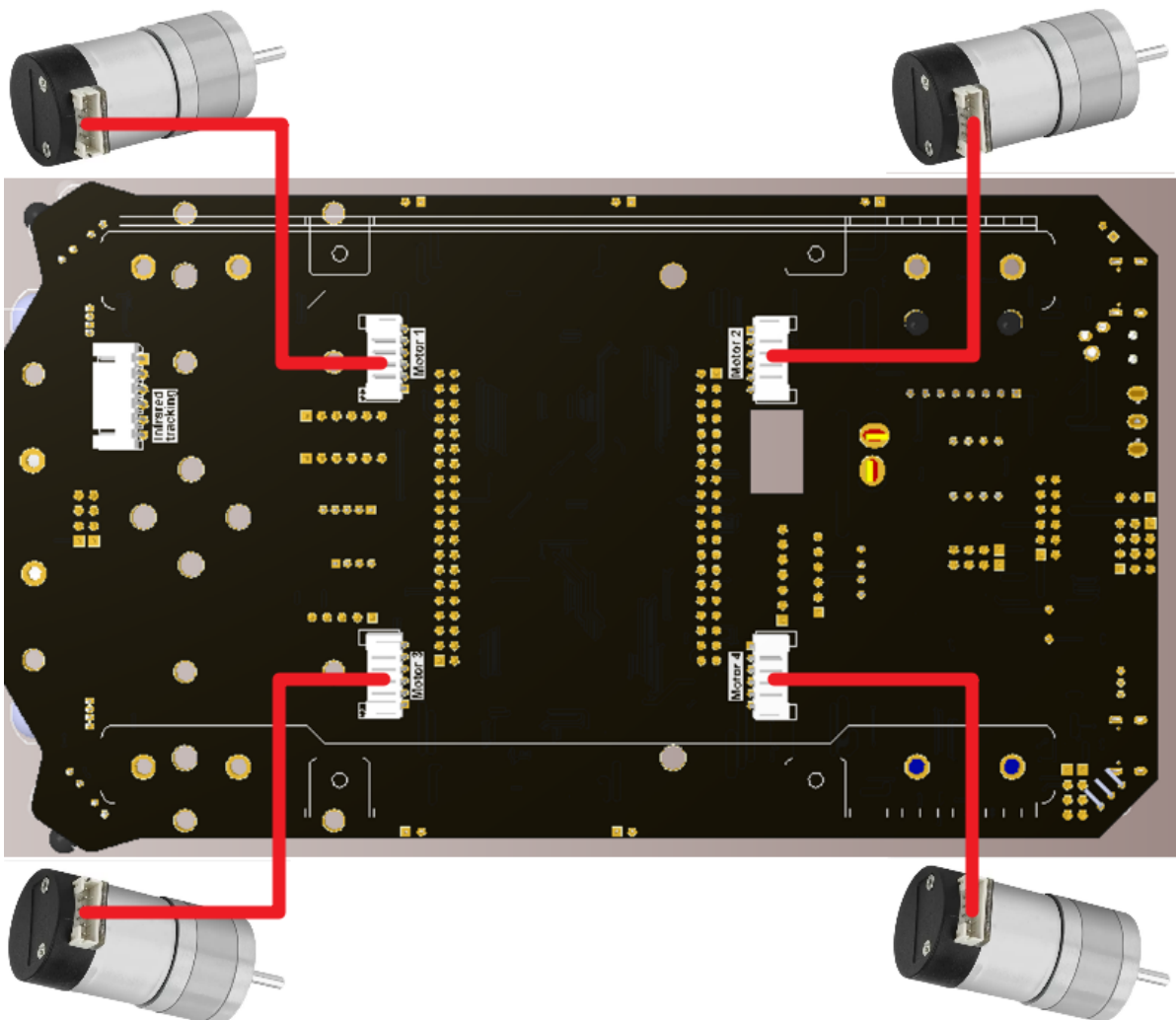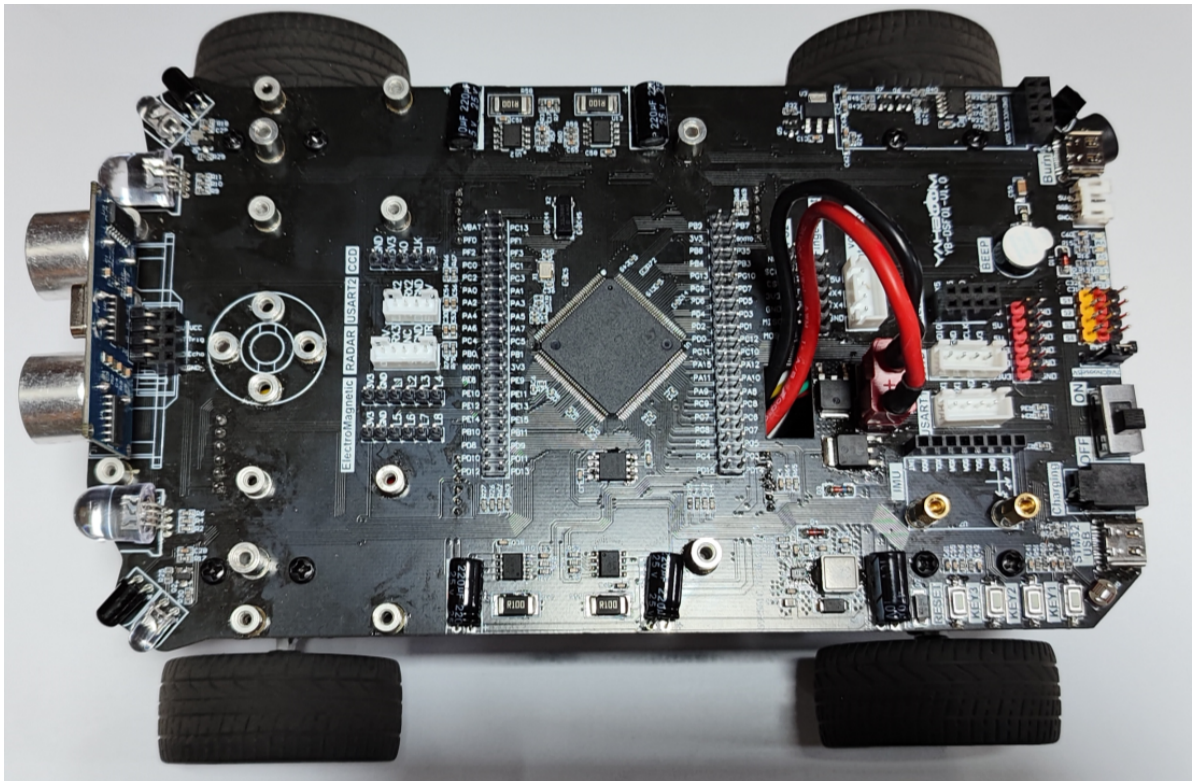
1. Hardware schematic diagram

2. Physical connection diagram

- **Ultrasonic Installation**

- **Motor Wiring**

3. Control principle

The distance of the object in front is obtained through the ultrasonic module, and the car is controlled to move forward, backward, turn left, and stop based on the distance.

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The ultrasonic module can obtain the distance of the obstacle in front, and we
use this distance to determine the position of the obstacle on the car:
If the obstacle is within the distance range set by the car, we call the car's
stop, retreat and left turn functions in the corresponding judgment function;
If the obstacle is not within the distance range set by the car, control the car
to move forward.
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- **Program flow chart**
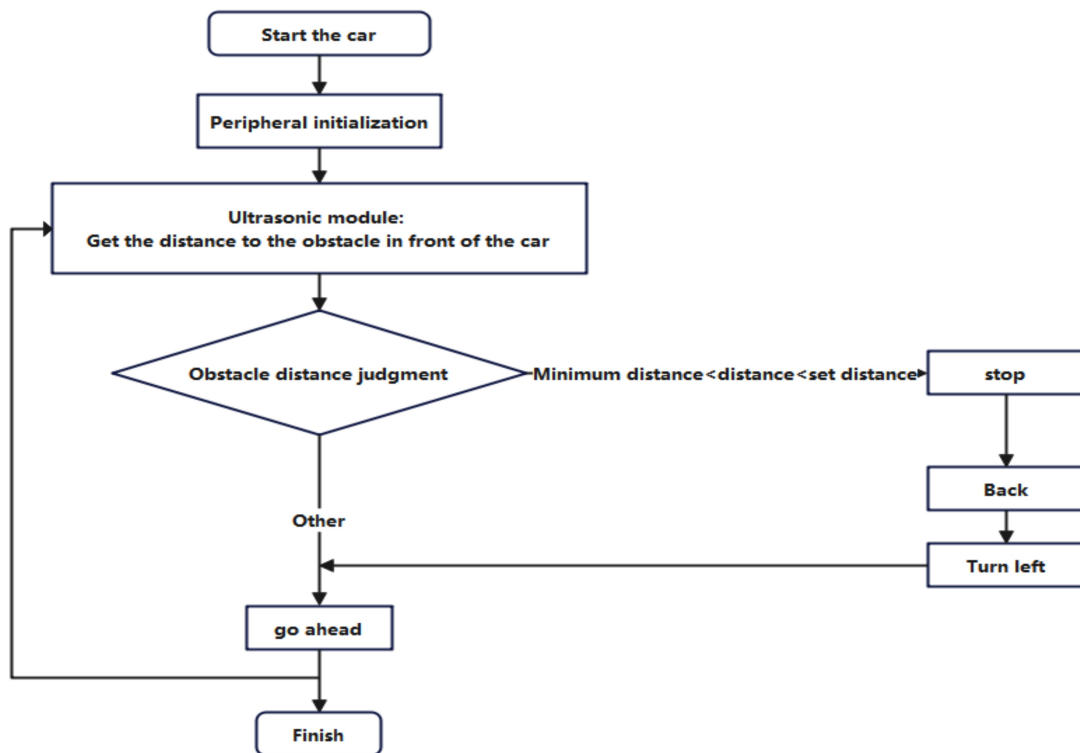
Module	Function
Ultrasonic module	External information collection: Obtaining the distance to obstacles
Motor	Motion Control

3. Main functions

This tutorial does not use PID to control the movement of the car

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The functions introduced before will not be introduced again!
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> **Function: Ultrasonic_avoidance**

Function prototype	void Ultrasonic_avoidance(uint16_t distance)
Function description	Ultrasonic following
Input parameters	**distance**: maximum obstacle avoidance distance
Return value	None

```
For the underlying driver, you can refer to the tutorials in Chapter 3 and
Chapter 4.
For the application layer, you can read the source code in the project file
yourself
```

4. Experimental Phenomenon

After successfully downloading the program, press the RESET button on the development board to observe the effect of the car!

> For program download, please refer to [2. Development environment construction and use: program download and simulation]

Phenomenon:

Obstacle: The car backs up and then turns left

No obstacles: Car moves forward

> For experimental phenomena, you can see [Ultrasonic Obstacle Avoidance_Experimental Phenomenon.mp4]