# 2D Map-Drawing Car

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Introduction

The 2D orographic-detecting robot has two main functions. One is to avoid obstacles which are detected by the sensors, and the other is to build the floor map by plotting the position of the obstacles on the computer. There are two sensors on the device, and they can detect the distance of the obstacles in two directions – front and left. We use the front sensor to avoid the obstacles, and we use the left sensor to draw the obstacles. Once the distance of the front is small than 25 centimeters, the device will turn a direction in order not to bump into the obstacles. The Bluetooth receiver HC-05 can send the signals, detected by the sensor, back to the computer. The computer records the position of the obstacles immediately. After the computer has finished drawing the floor plan, we can save it to the computer.

The flow chart

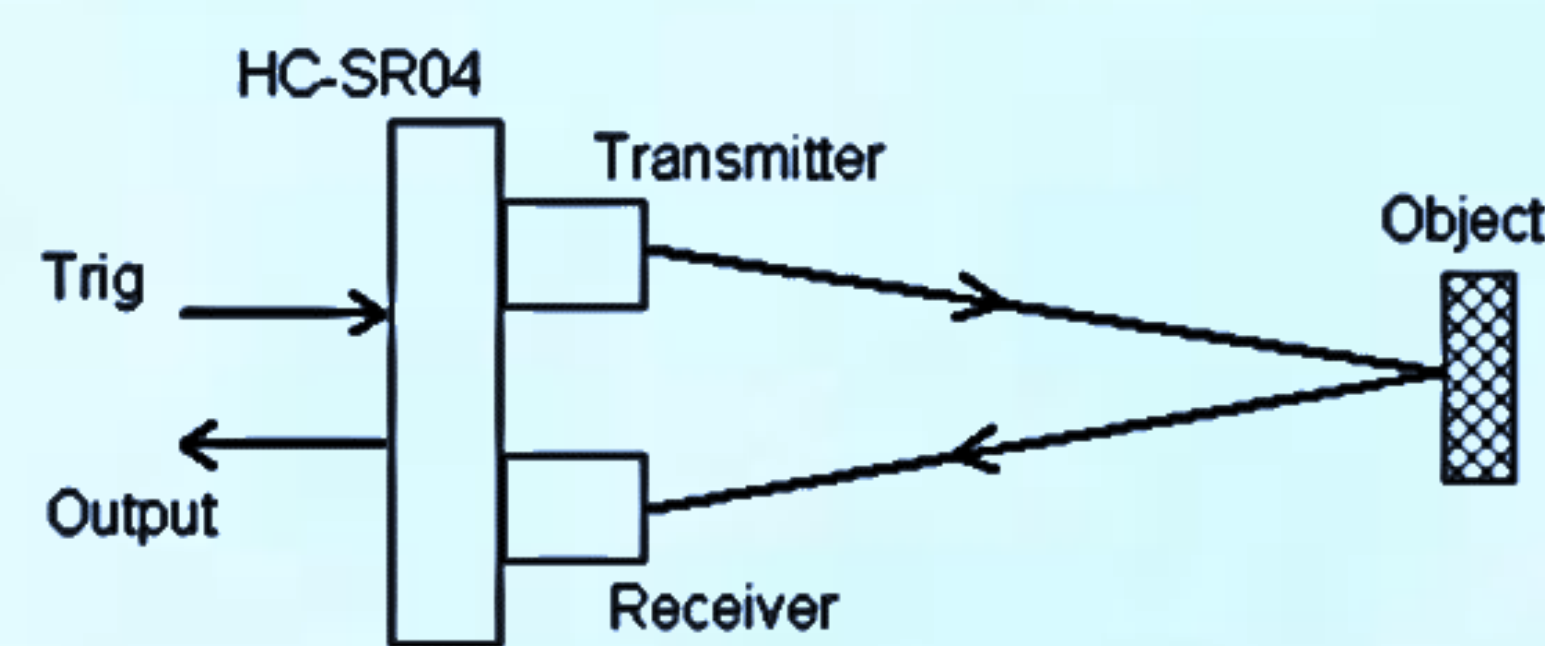a. To control the direction of the device
   d_F: the front distance
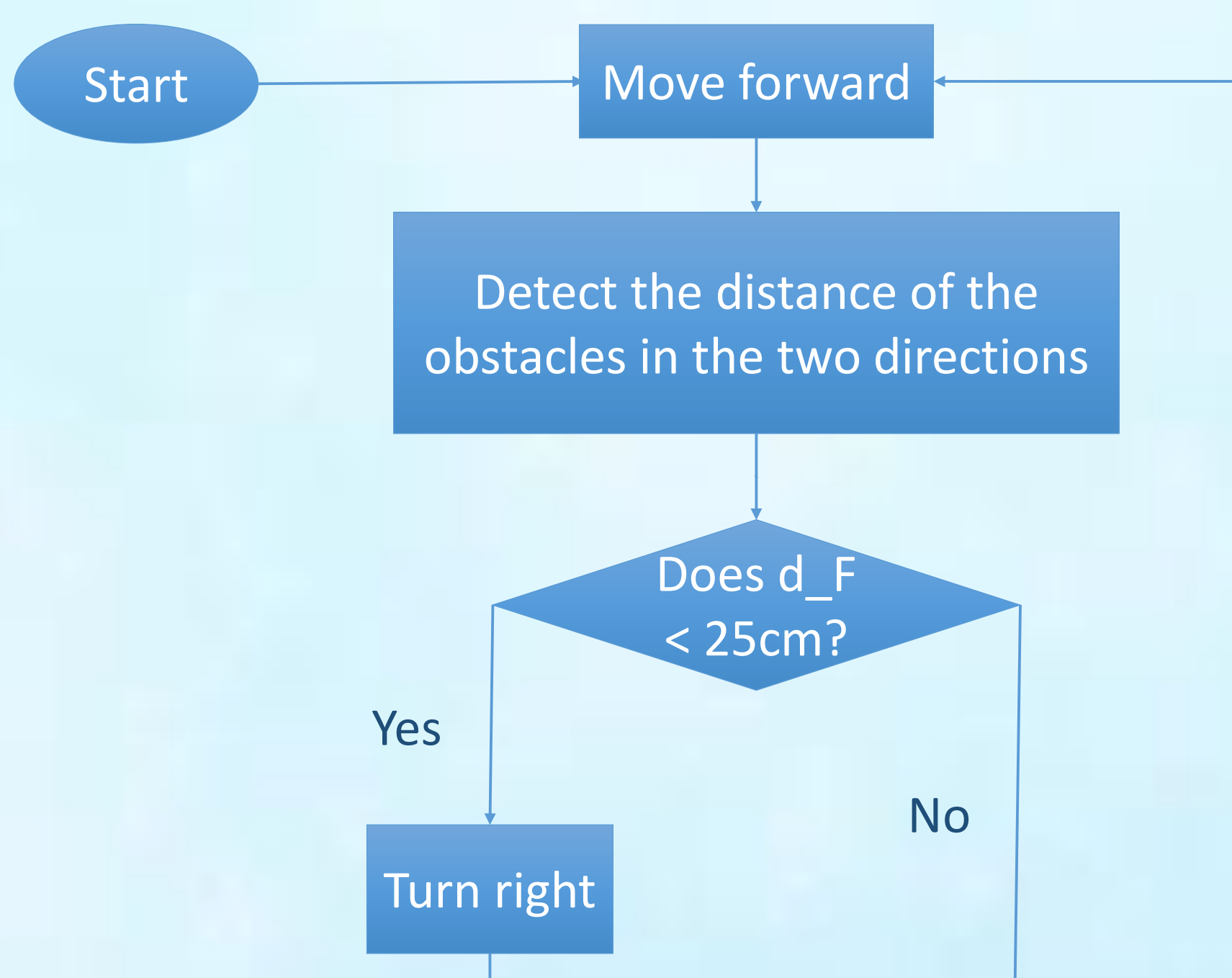

b. To build the floor plan
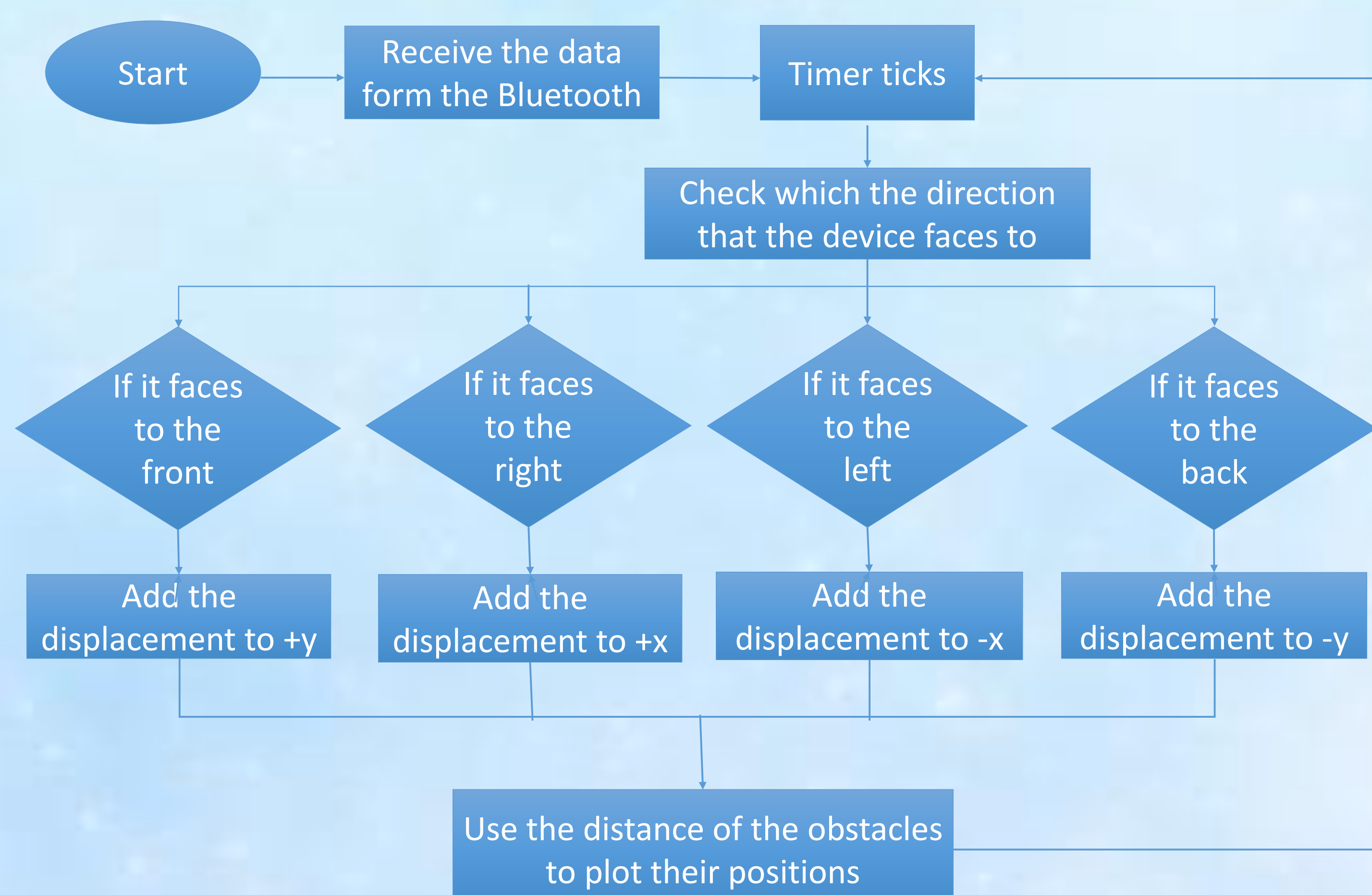
Principle

Ultrasonic sensor HC-SR04

* Speed of sound: 331.4+0.6T m/s

* With the temperature 25℃, the speed of the sound is 0.03464 cm/microsecond.

* $distance = \frac{speed\ of\ sound \times time\ taken}{2}$

The principle of the ultrasonic sensor HC-SR04.
http://coopermaa2nd.blogspot.tw/2012/09/hc-sr04.html

Specification of HC-SR04	
Inductive distance	$2\sim400(cm)$
Accuracy	$\pm0.3(cm)$
Inductive angle	$15°$
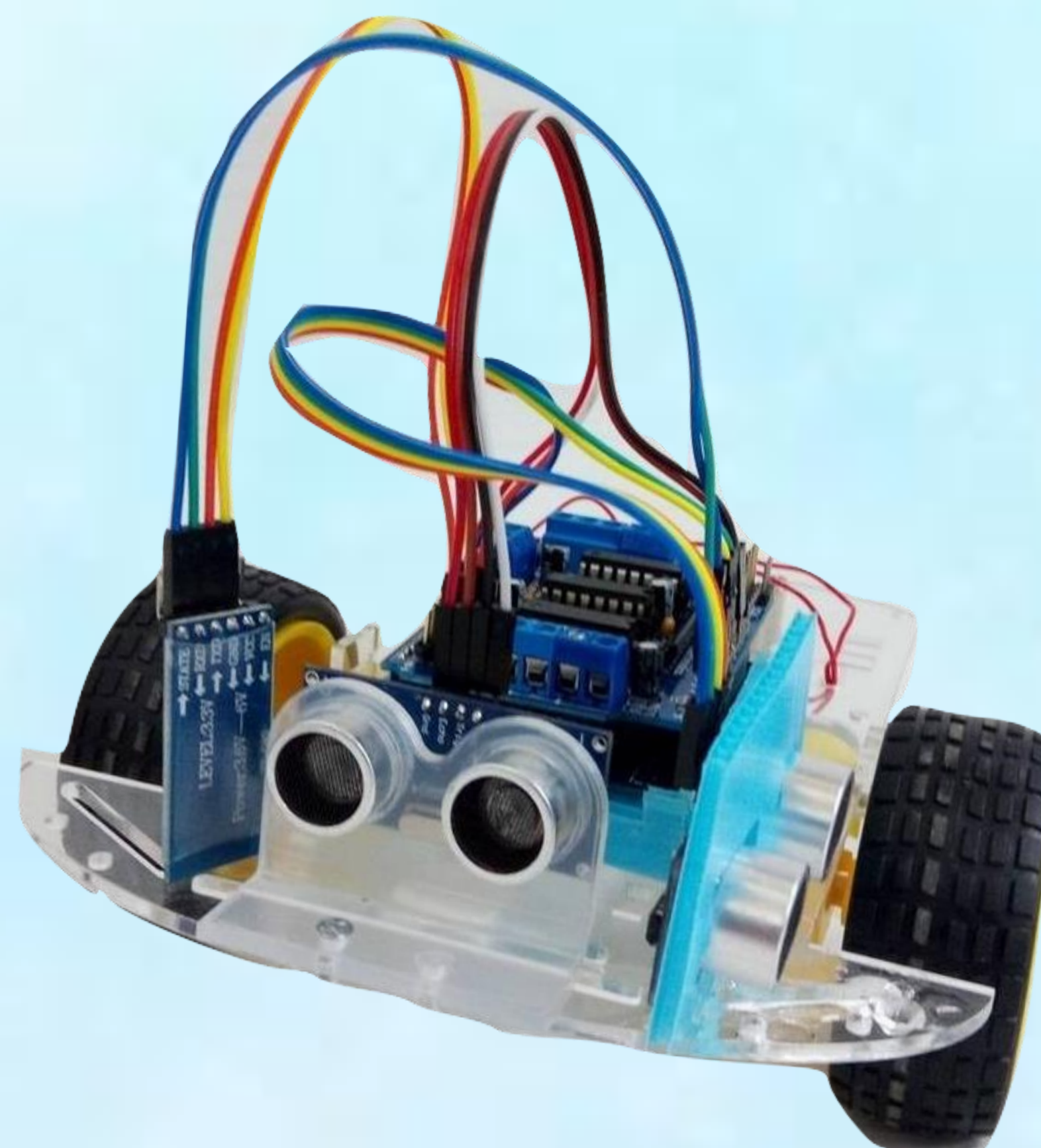
DC motor

* The direction of the current will change after the coil turns 180°.

* By using the Ampere's law, we can know the direction of the force.

* It is a brushed motor, so it will generate the noise and the abrasion.
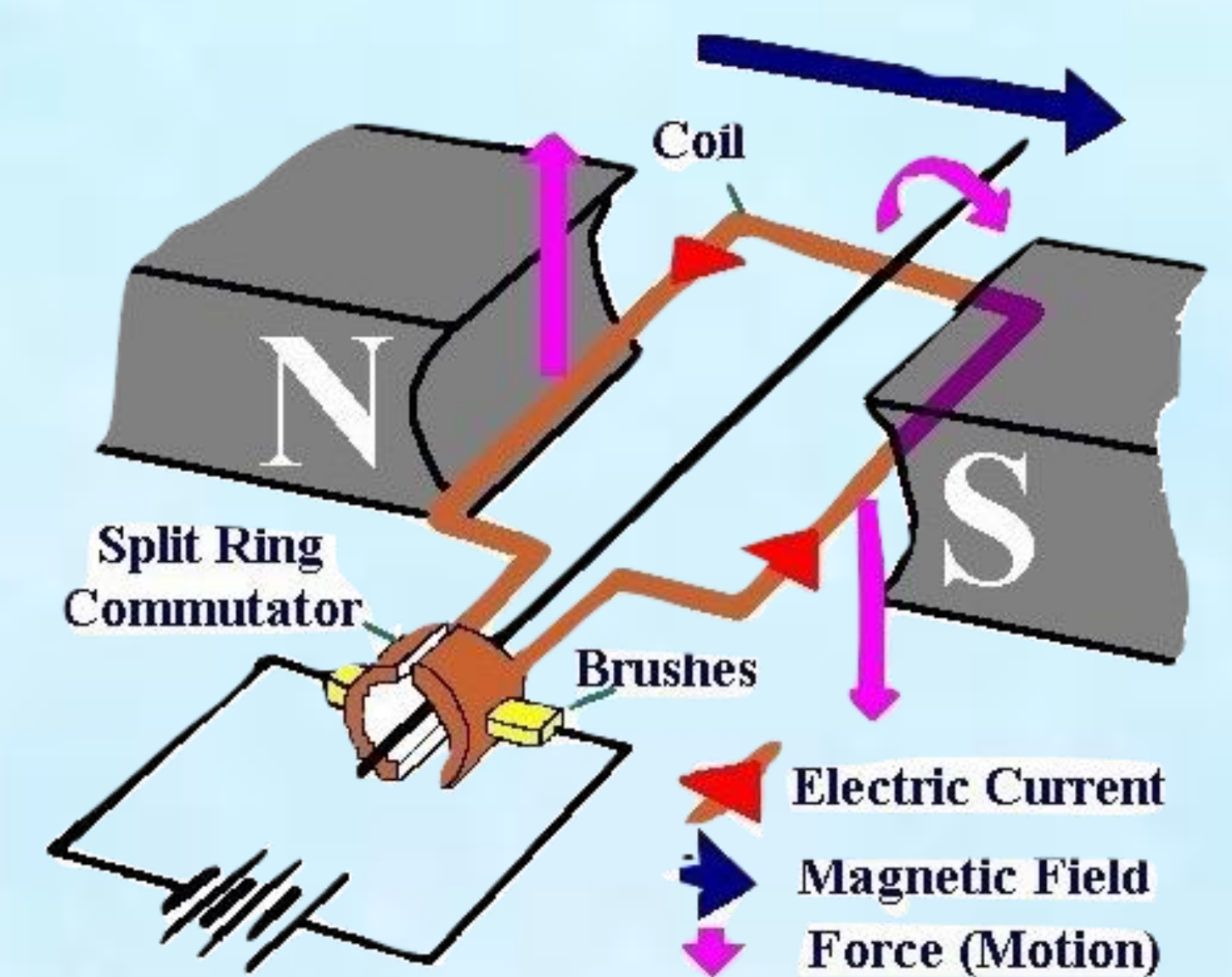
http://www.oocities.org/rjwarren_stm/Physics_Notes/U4_Motor.html

Result

Figure 1 is the floor plan built by our device. The red line is the trajectory of our device, and the black line is the board of the obstacles.
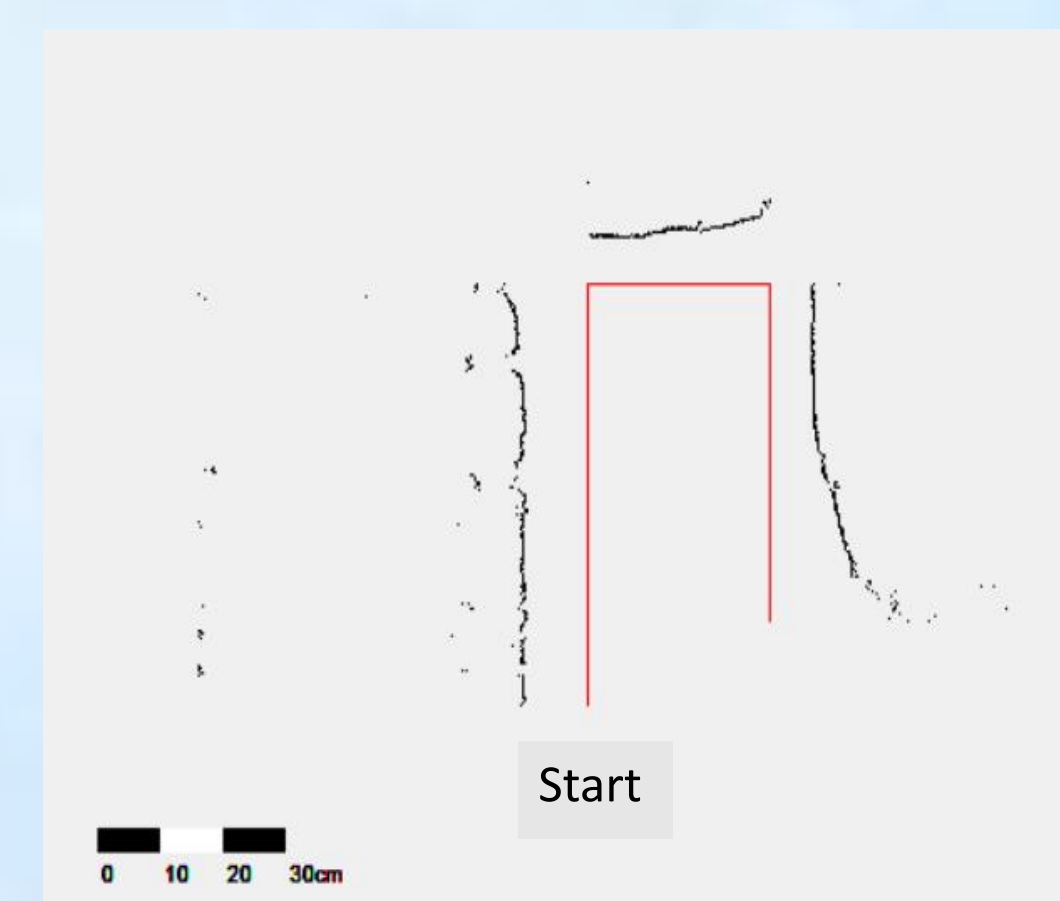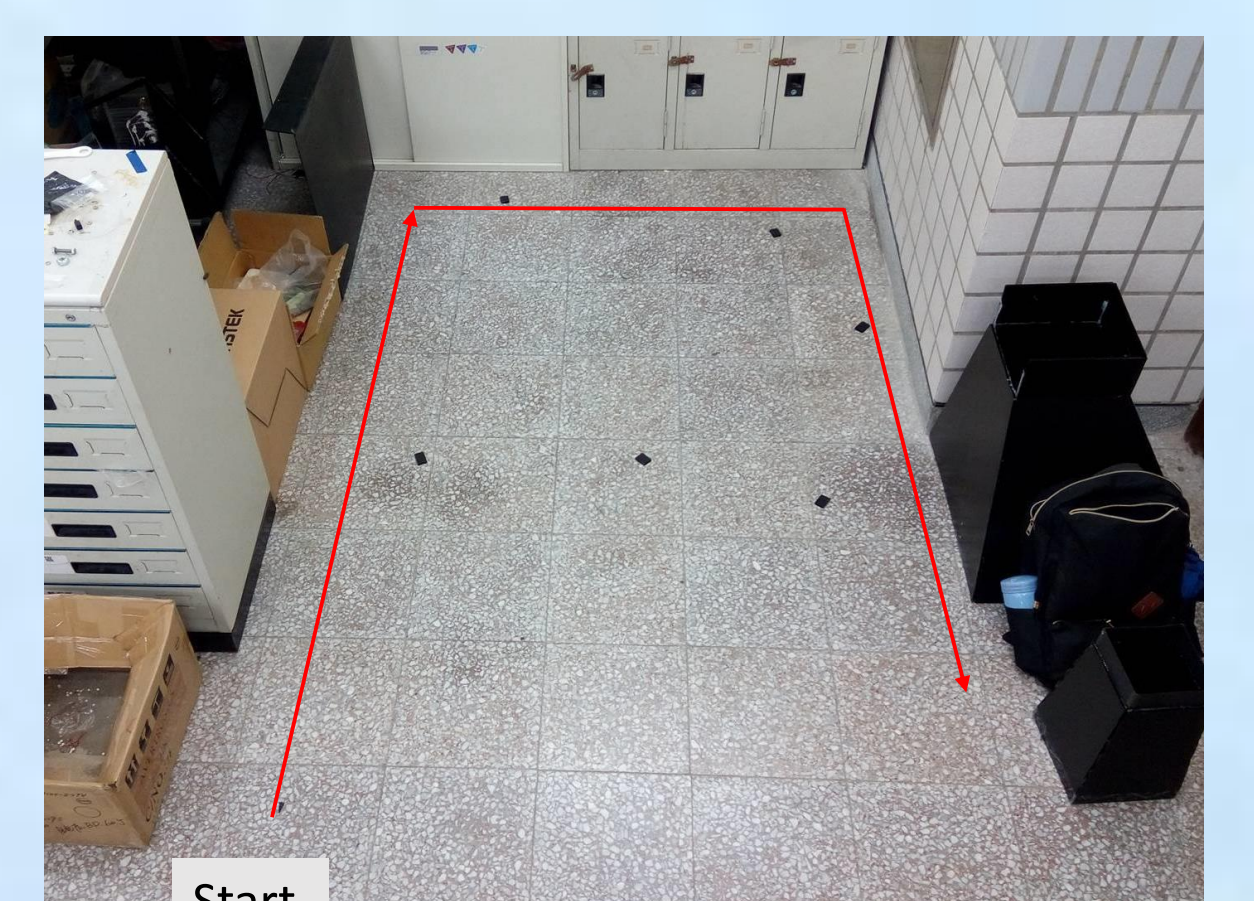

Figure 1. The floor plan.

Figure 2. The obstacles.

Conclusion

The car can build the floor plan by using the left sensor, and it can avoid the obstacles by using the front sensor. There might be some deviations because the operational speed of the motor shield is low, and the car will not go straight sometimes. Besides, the car cannot draw the obstacles while it is turning, so it cannot draw the corners.

Reference

[1] http://coopermaa2nd.blogspot.tw/2012/09/hc-sr04.html

[2] Jung-Hua Chou, "Environment Map Building for Mobile Robot by Ultrasonic Sensor", 2007