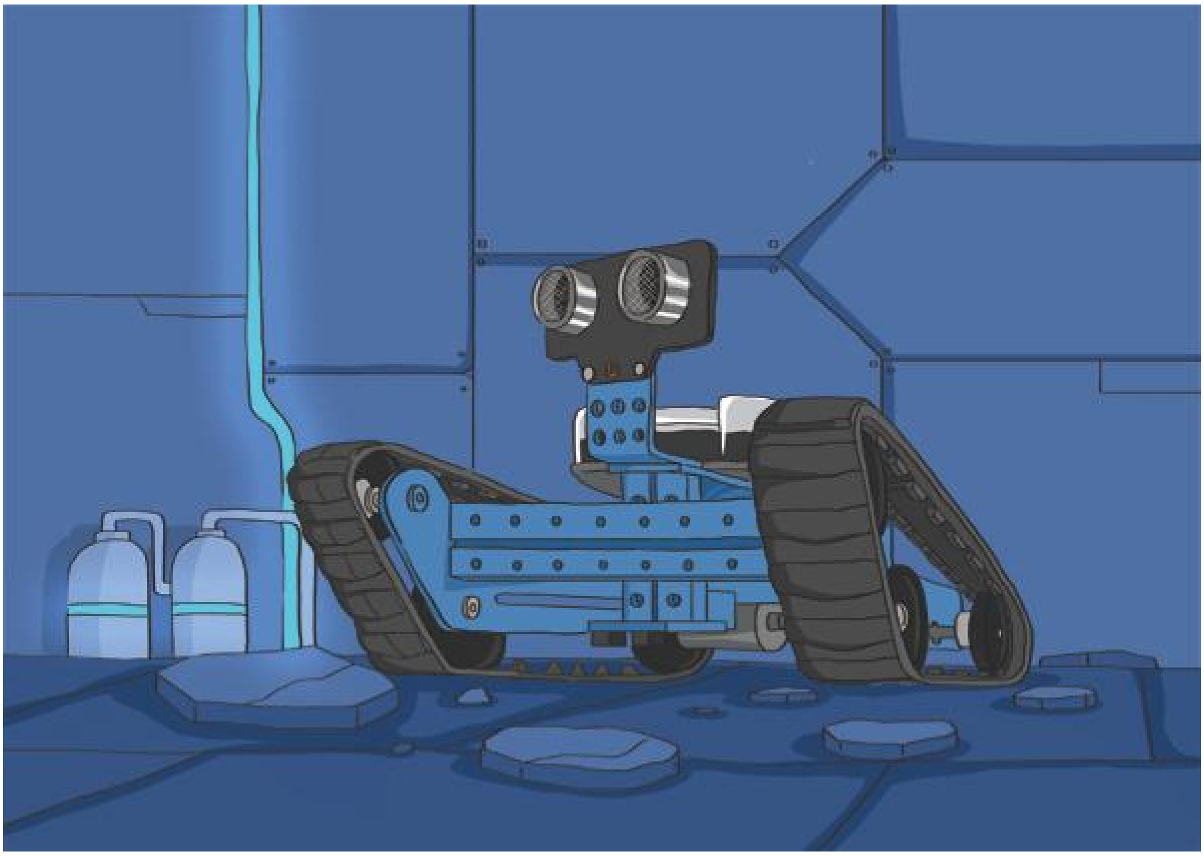
Decision



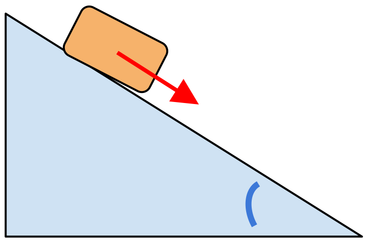
The quicksand is sinking faster and faster, and none of all emergency operations work. Mark is sweating at every pore and says to himself, “Will we be buried alive that?” He quickly orders all the people to fasten their seat belts to prevent any possible accidents.
“Boom!” a sudden drop for a short period of time causes the vehicle body to touch the bottom. It seems to be a solid metal surface with a considerable slope. Due to the continued inrush of sand, Ranger Tank fails to park on the ramp, and keep gliding with the rolling sand along the slope. Before the searchlight is damaged by a protrusion beside the ramp, all the people see an enormous space in the ground in front of them.
With the gradient gets more even, Ranger Tank stops sliding but is still afraid to move ahead. How can they look for a way out in the pitch blackness? Jennifer turns Ranger Tank on the spot and attempts to cast an eye at surrounding environment…
“There is the trace of infrared ray we tracked just now at the direction of six o’clock,” Peter shouts excitedly.

Learning Objectives

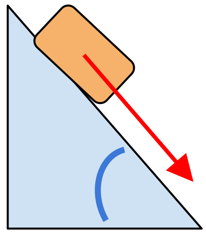
When a task is executed, provided that there is more than one preset condition, the judgment of a condition with priority must be carefully considered. In this chapter, not just with line following, we should know how to avoid obstacles. Is keeping online more important or avoidance of collision a key point - different ideas lead to different programs. Now, let’s have a try!

Scientific Knowledge

When it comes to the influence on the velocity of an object with fixed weight slides along the slope, the friction between the object and the slope is another important factor in addition to the gradient of the slope.

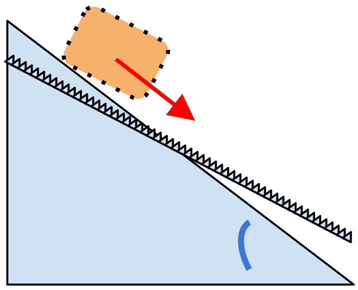


The smaller the gradient is, the slower the velocity is

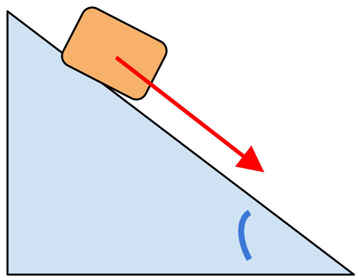


The larger the gradient is, the faster the velocity is

Friction is the resistance to relative motion between two bodies in contact.

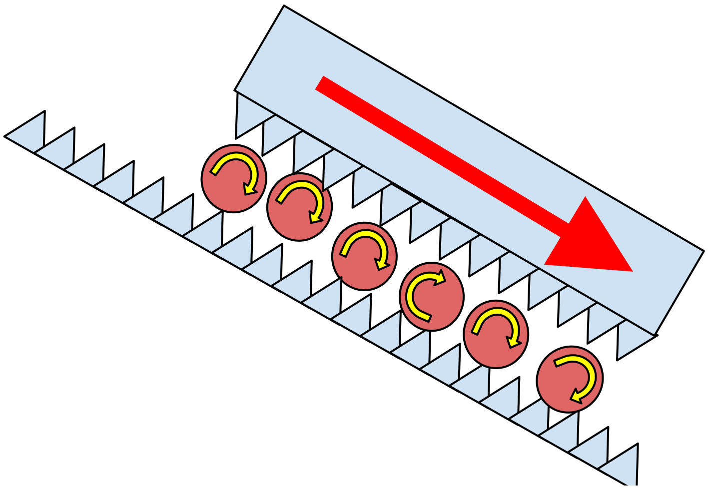


The more rough the surface is,
the larger the resistance is (large friction)



The more smooth the surface is,
the smaller the resistance is (small friction)

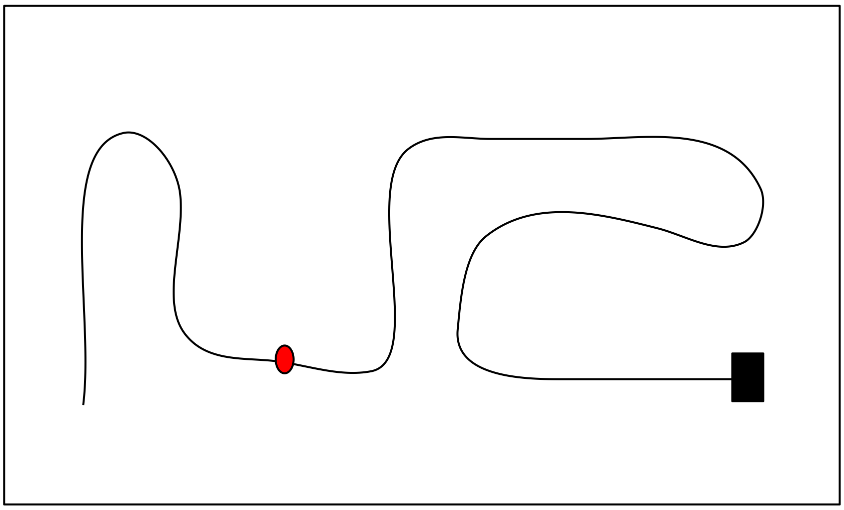
If a large number of tiny balls are laid on the rough surface that is not easy to move, the original friction will be reduced by these rolling tiny balls.



Rolling balls to reduce the friction on rough surface

Assembly Preparation

In this chapter we use off-road robot.
Prepare a roll of insulating tape and standard-sized newspapers to make a field map by ourselves.



Learning Tasks

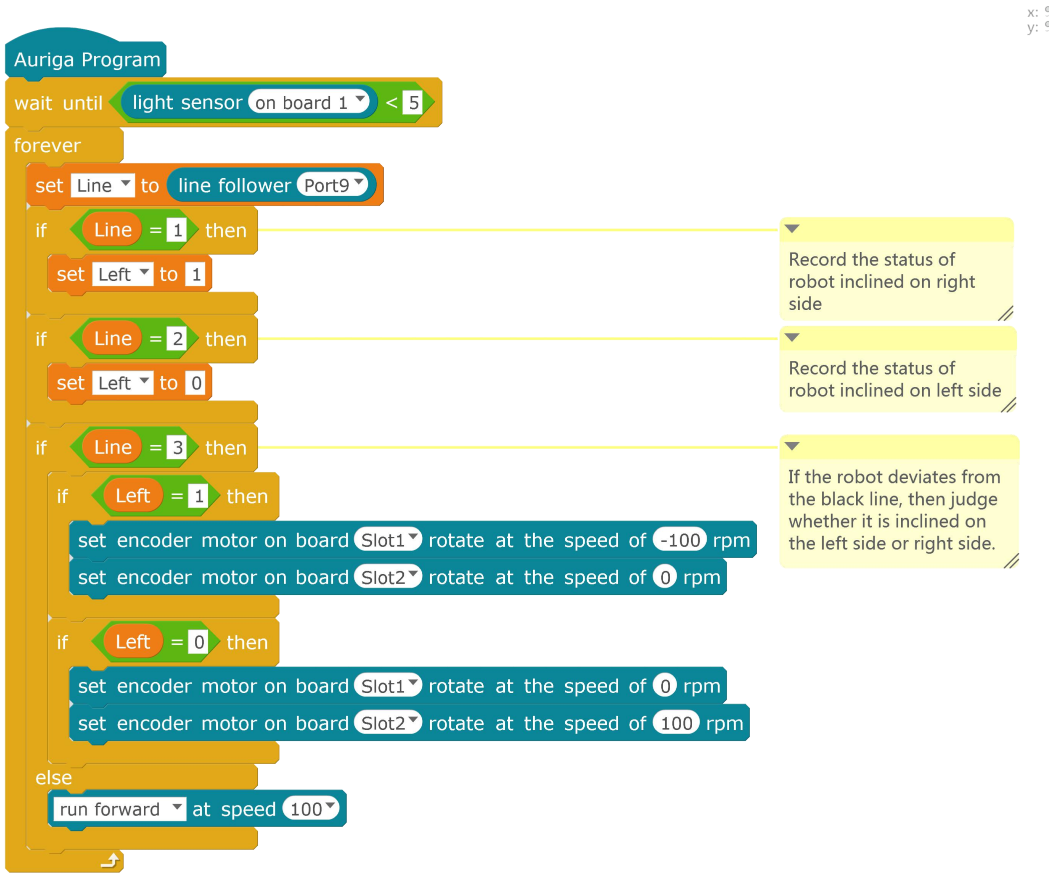
During program design, we generally adjust the judgment priority and decision mode according to the peculiarity of problems, so it is also a must to provide a relatively comprehensive observation for the cognition on problem status.

Learning Task 1 – Narrow-line Version of Line Following Task (Change of Decision Mode)

In the use of line following sensor, the space between the two reflective infrared sensors

on the module is a fixed value. In the case of different track widths, the mode of program judgment must be adjusted to improve the efficiency of line following.
For the insulating tape that is used to stick an 18mm-wide track, if the basic line following logic is used for judgment, we can find that the speed the robot advances gets too slow.
According to observation, we find the small width of insulating tape causes the time of the vehicle body in the state of forward (value of sensor = 0) to be very short. The body inclines left or right in the rest of the time, which leads to the deviation of the saw-like forward path, greatly affecting the forward velocity.

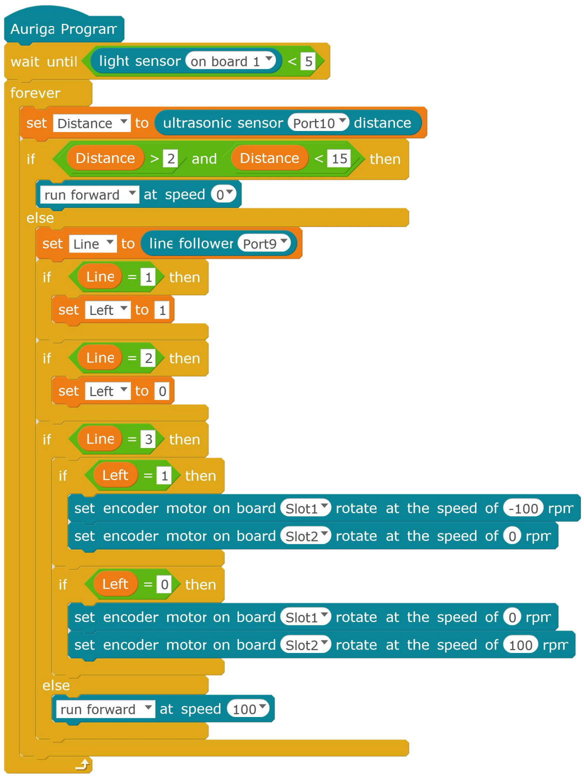
To appropriately address the problem, we adopt the method by recording the state of off-track first and commanding the robot to go back to tract after the line following sensor leaves the track.



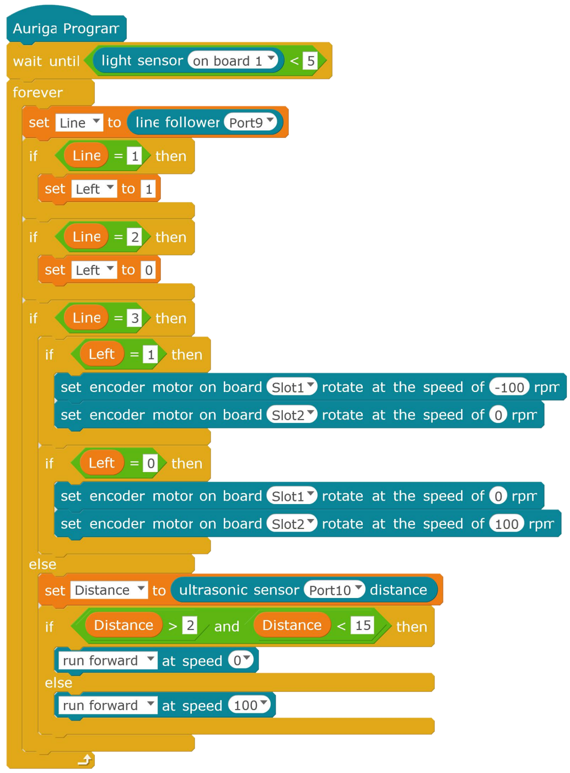
Through such a change, we find the robot is always in the state of forward only if both of the two sensors on the line following module do not go off the track at once, greatly improving the forward velocity on the line.

Learning Task 2 – Park first or Go back to the Line first (Change of Judgment Priority)

The following are two sample applications where the programs have functions of line following and detection of the stopping of obstacles, but with different writing. Could you try to describe the differences between the two programs according to your observation?



〔EX14-1〕



〔EX14-2〕

Have you found the differences?

〔EX14-1〕 The focus of the program design is on the avoidance of obstacles. Whether it is on the black line track or not, the robot will immediately stop once there is an obstacle.

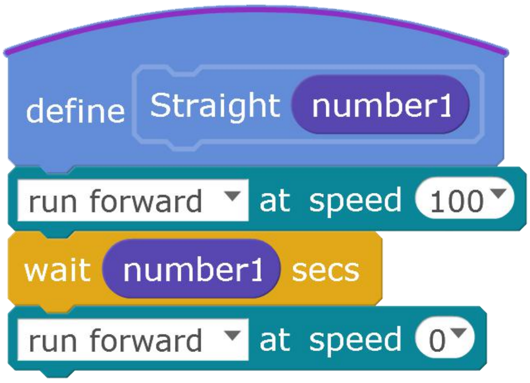
〔EX14-2〕 The focus of the program design is on the necessity of the robot to avoid obstacles. If the robot goes off the track, the task of returning to the track must be a priority.

Therefore, if you fail to conduct a careful observation and analysis or understand the needs of a task, the program you write will lead to accidental errors at a crucial time even if the execution results look largely identical but with minor differences, failing to meet the actual requirements.

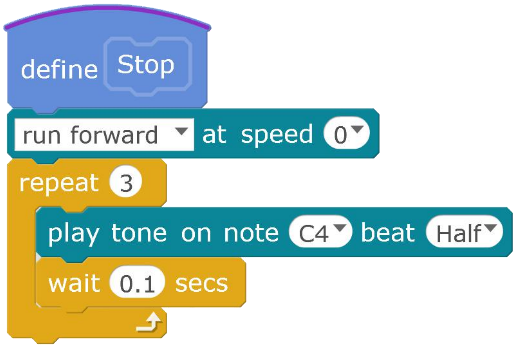
Target Task

Target Task 1 – Turn Left or Turn Right

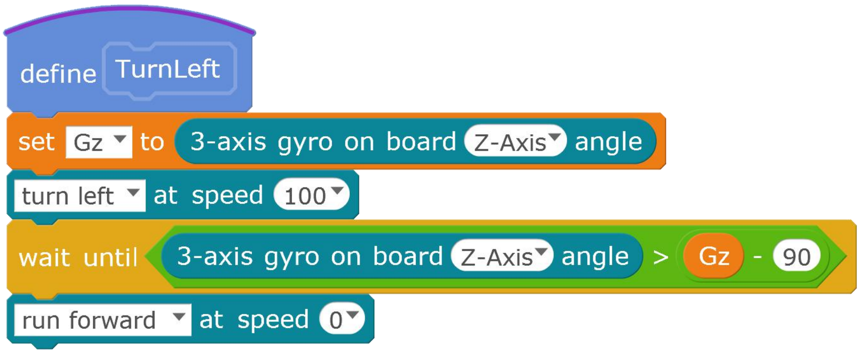
We break down obstacle avoidance action and add several new block commands



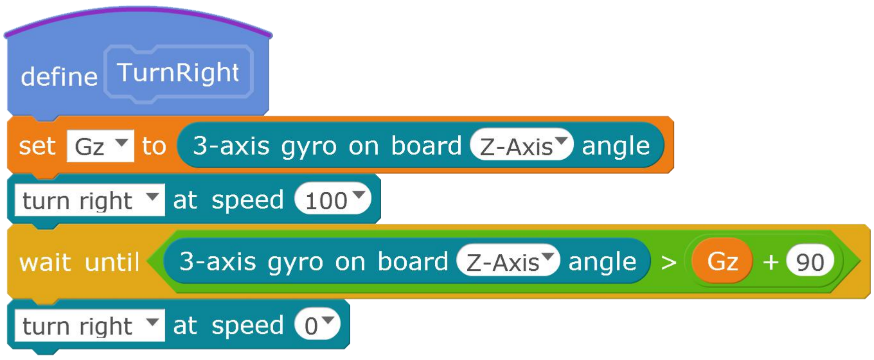
Advance fixed distance without any conditions



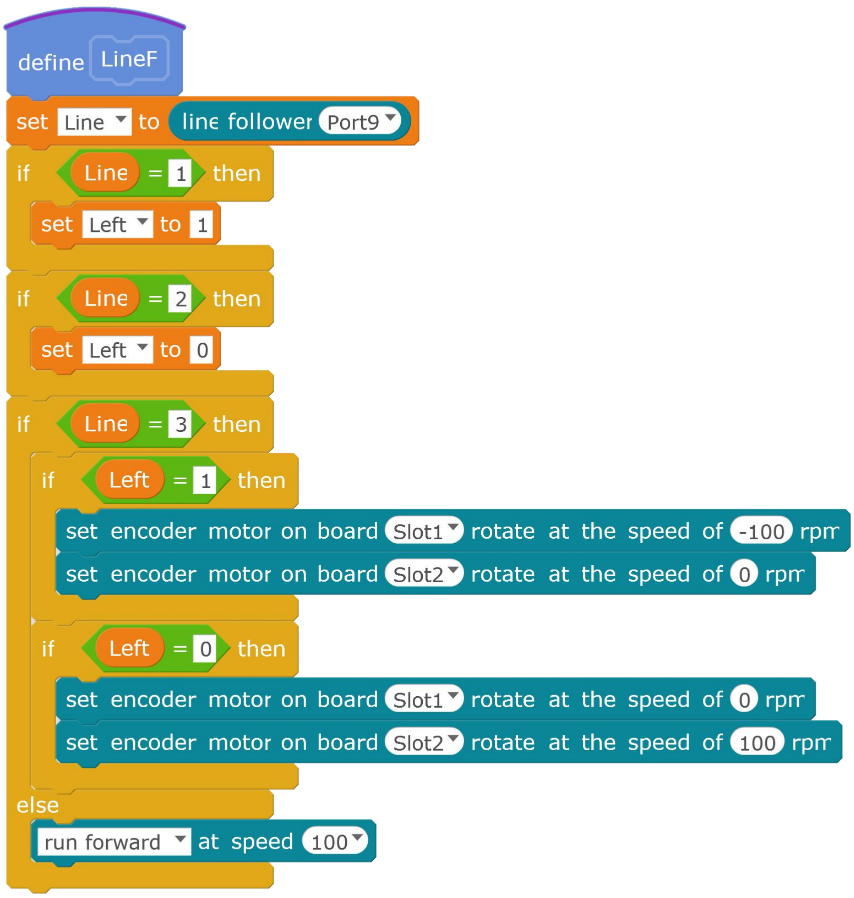
Stop advancing and alert a sound



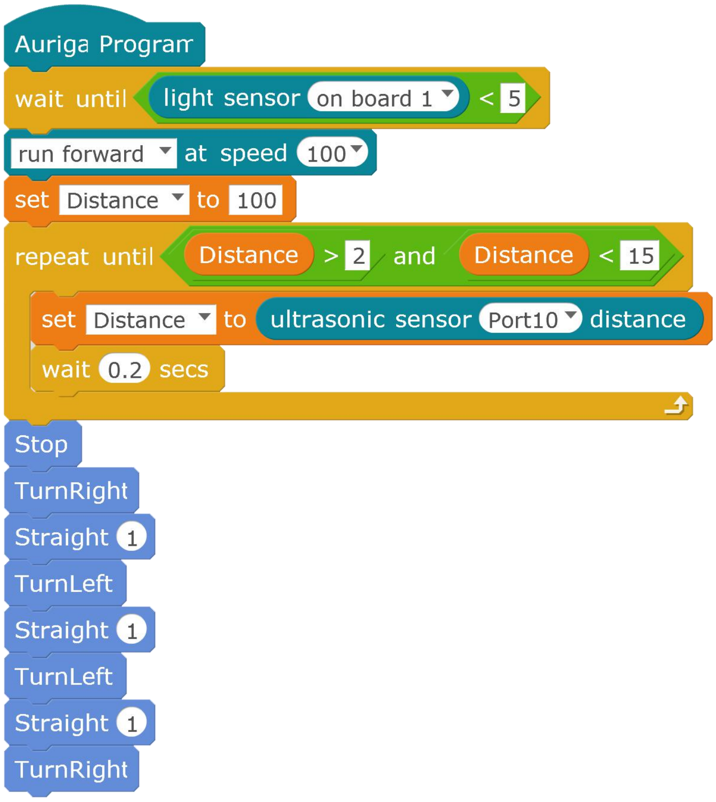
Turn left 90 degrees by fixing gyroscope



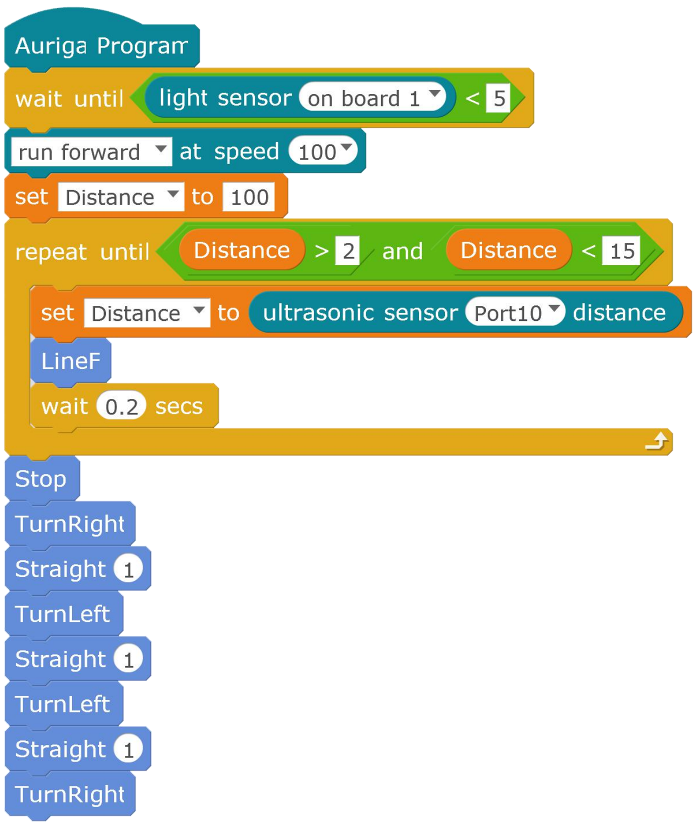
Turn right 90 degrees by fixing gyroscope



Line following function



〔EX14-3〕Turn left or right in combination with obstacle detection



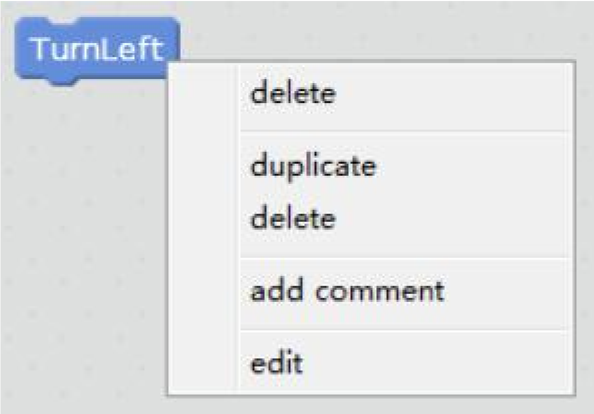
〔EX14-4〕Add line following function 〔LineF〕

Target Task

Target Task 1 – Optimal Rerouting Path

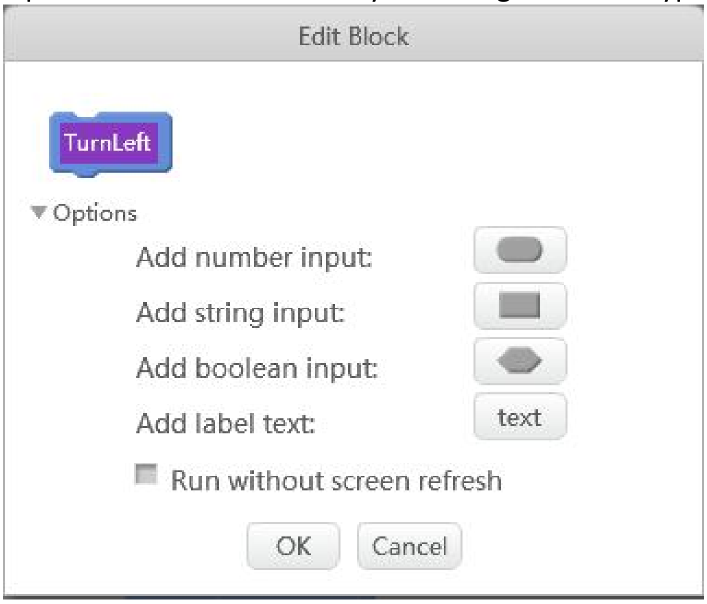
Use parameters to control the turning angle of robot

Modify established block commands

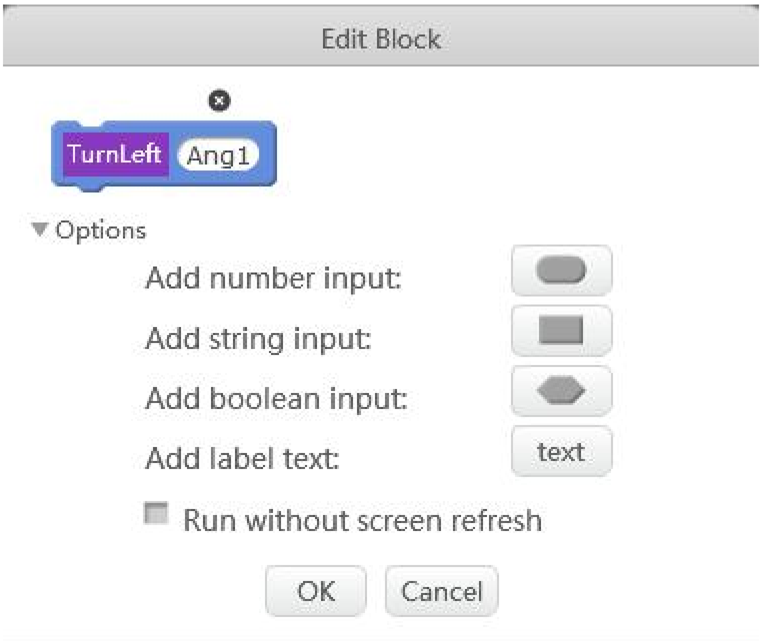


Right click the block to be edited for editing

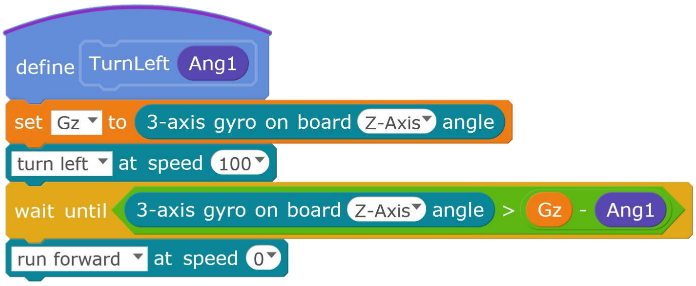
Click the option
Add parameters – choose newly added figures to be typed



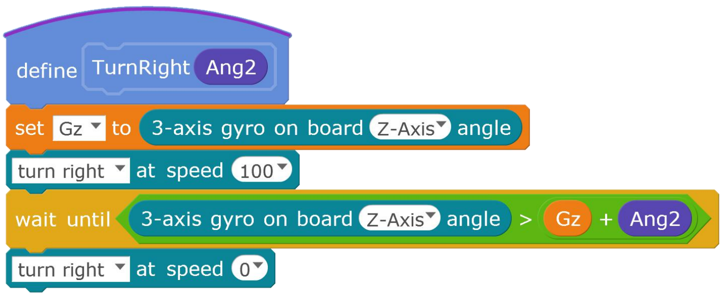
Check the name of parameters to be modified



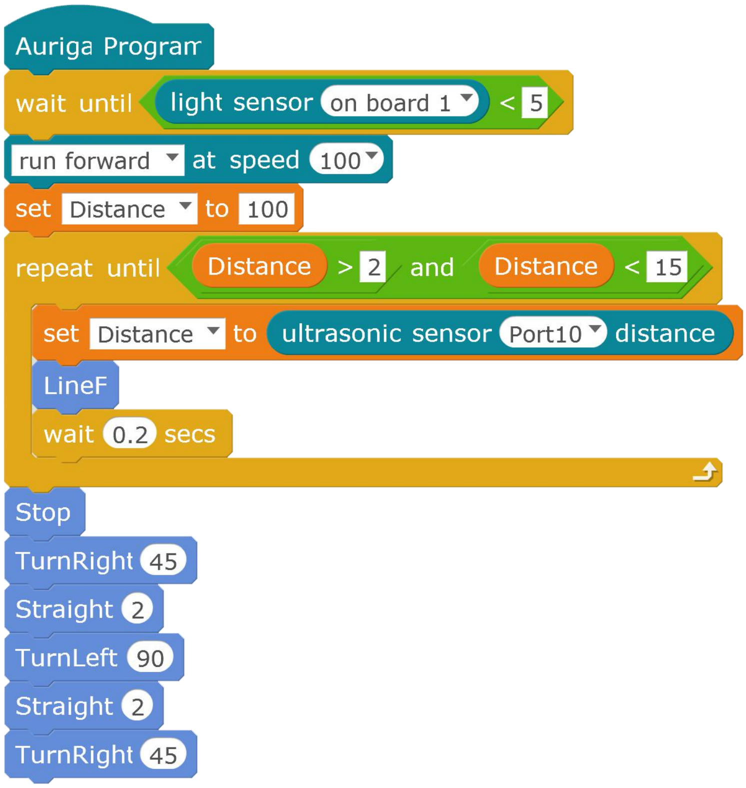
Confirm after completion of name modification
Include the parameter into the block



Complete the operation of using parameters to control the angle of turning left



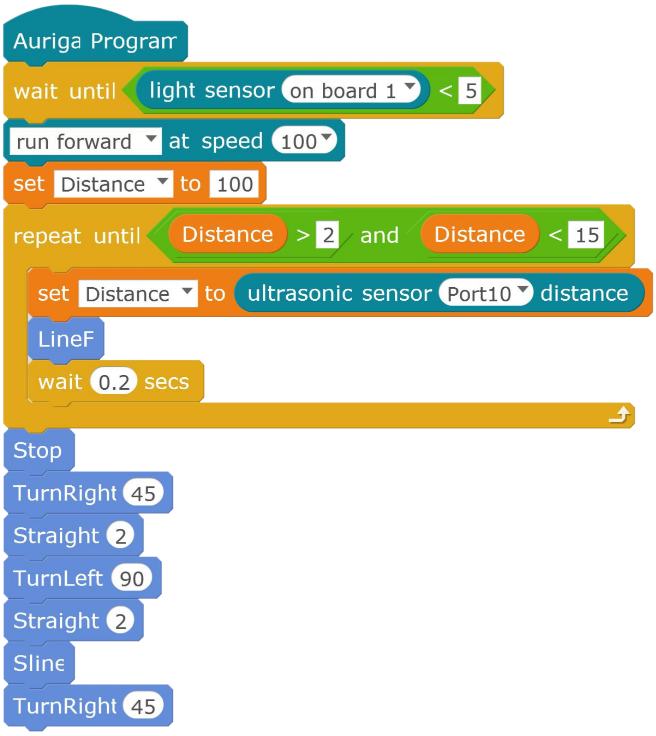
Complete the operation of using parameters to control the angle of turning right



〔EX14-5〕 Use parameters to make program modification more intuitive

Target Task 2 — Identification of Black Line

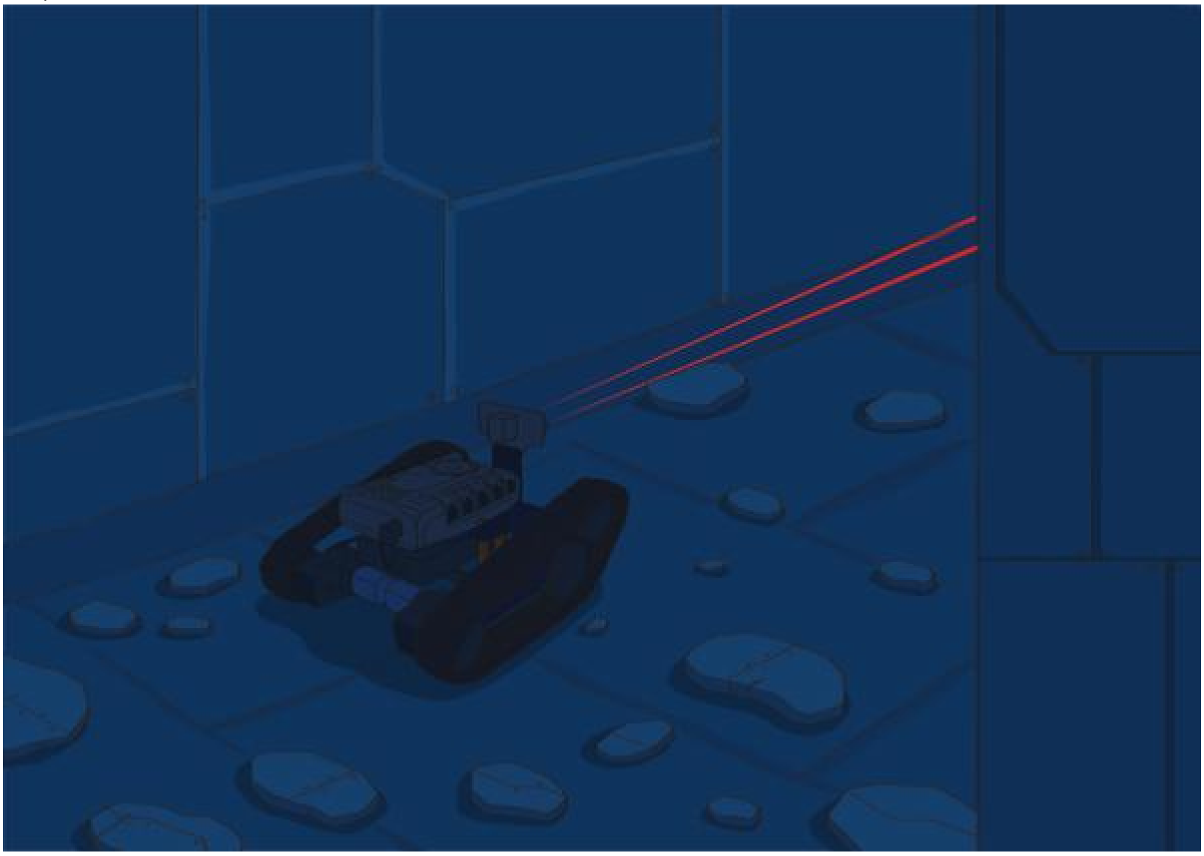
Use line following sensor to finish obstacle avoidance action



〔EX14-6〕Have a try to challenge faster speed!

Conclusion of This Chapter

For the development of general computer applications, if there are inadequate considerations, the worst case is the lost of data structure or shutdown. However, for the development of robot programs whose execution results are generally linked to the structure and action of entities, if there are errors as a result of the lack of careful analysis, they will cause the problems from the damage of entities to the possibility of endangering life, so we have to be more careful.



In pitch darkness, Ranger Tank can move ahead only by following the path of weak infrared rays on the ground. Fortunately, the ultrasonic sensor has not been damaged during the gliding. The road ahead to underground adventure proceeds after Peter adds the environmental distance data into infrared automatic line following system and readjusts the navigation mode…