

ENJOY AI 2024  
INTERSTELLAR JOURNEY

# CLOSING CEREMONY OF SPORTS



# Making Turns

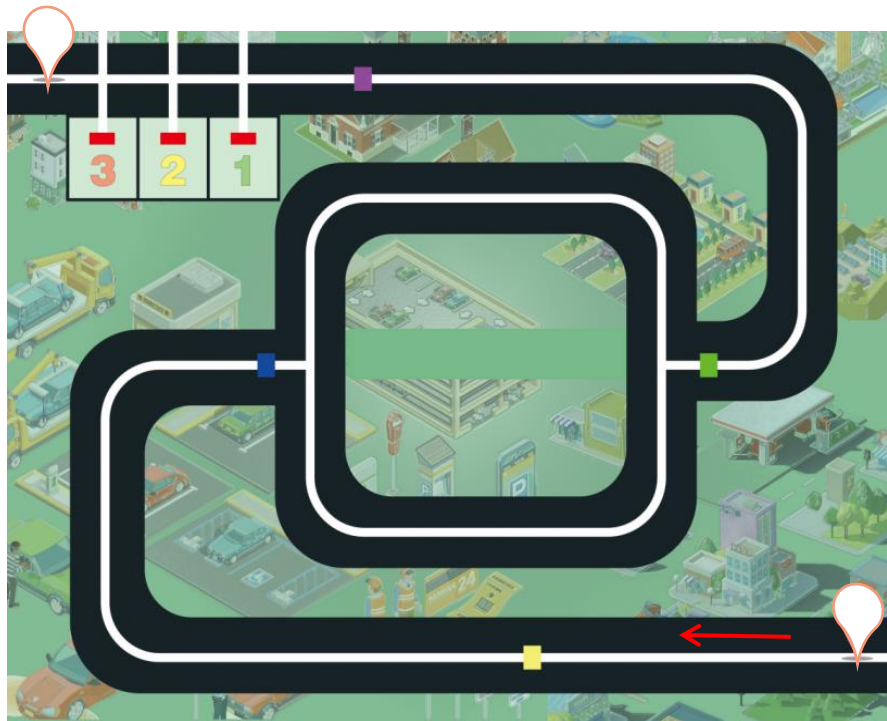
## Objectives:

1. Know how to use grayscale sensors
2. Know how to use the code blocks for single grayscale and 5-in-1 grayscale
3. Know how to use the code blocks to make turns

5+



## Review



In the previous course, we tried several line following tasks.  
Do you remember the parameters used in line following?



# Review

1. What happens when the speed of line following is too high?
2. How to avoid insufficient turning at intersections? Which parameters can you use?
3. What are the differences between code blocks for turning in the “Patrol line” module and those in the “Motion” module?

# Challenges



## Challenges



We have learned line following and related coding skills. Do you know how the robot makes turns?



## Challenges

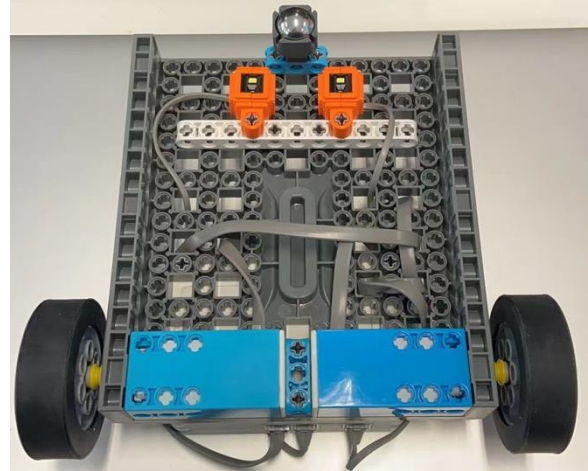
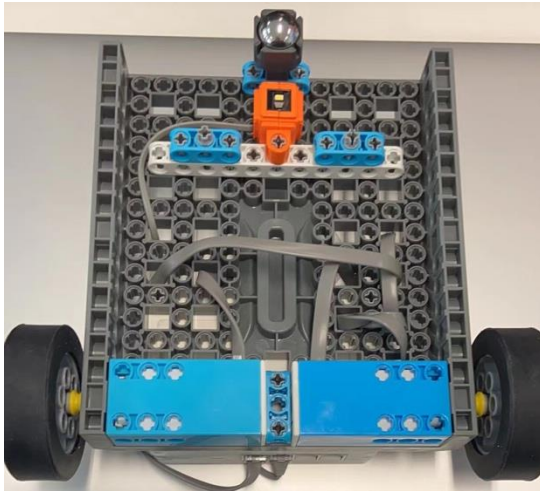


The robot makes turns by using a grayscale sensor.



# Challenges

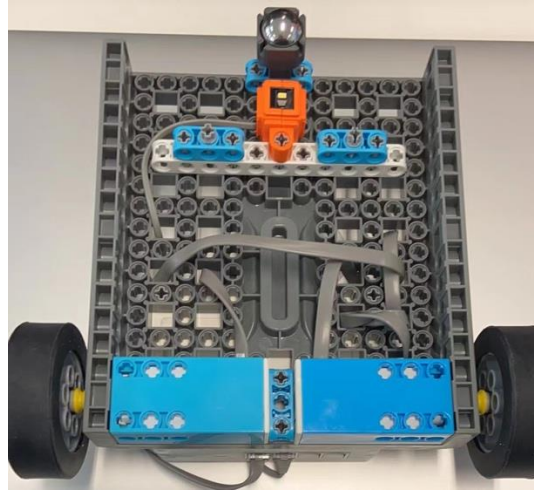
## Impacts of Grayscale on Line Following



Grayscale can be classified into three types:  
single grayscale (Image 1), dual grayscale (Image 2), and multi-in-one grayscale (Image 3)

# Challenges

## Impacts of Grayscale on Line Following



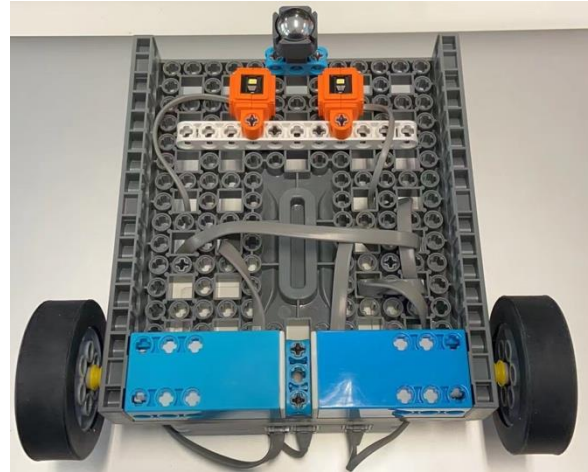
**Single grayscale:** Use one grayscale sensor to detect whether the robot is deviated from the black line.

**Pros:** easy to code; installed in the middle

**Cons:** may cause deviation in high-speed scenarios

# Challenges

## Impacts of Grayscale on Line Following



**Dual grayscale:** Two sensors work together to detect black lines.

**Pros:** clear coding logic; relatively stable line following

**Cons:** cannot handle complicated scenarios, such as T-intersections and turning

# Challenges

## Impacts of Grayscale on Line Following



**Multi-in-one grayscale:** Use at least three grayscale sensors to detect black lines and make turns.

**Pros:** Decide the turns to make at intersections.

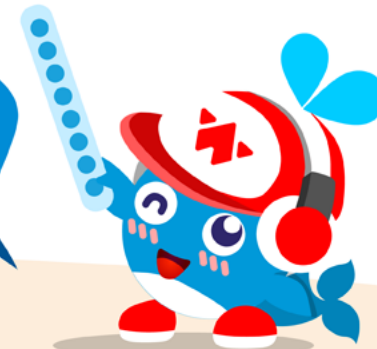
**Cons:** The room may be insufficient to install multiple sensors.

# Challenges

Challenges accepted!



After we discuss the types of grayscale, let's have a look at the code blocks about grayscale!



# Experiment 1

## Detect Black Lines Through 5-in-1 Grayscale

integrated grayscale port 5 ▾ channel 1 ▾ detected black ▾

In this experiment, you are going to specify a port and a channel to detect whether there's a black line ahead.

Port: a place where a connection wire can be plugged in to connect to the controller

Channel: the number on the sensor



# Experiment 1

## Detect Black Lines Through 5-in-1 Grayscale



A grayscale value that is displayed on the sensor screen ranges from 0 to 100.

If no obstacles are detected within a specific height, the grayscale value is 100.

If the sensor is covered by a hand, the grayscale value is 0, which indicates the white color.

If the sensor detects a black line, the grayscale value is 100.

## Experiment 1

### Detect Black Lines Through 5-in-1 Grayscale

integrated grayscale port 5 ▼ channel 1 ▼ detected black ▼

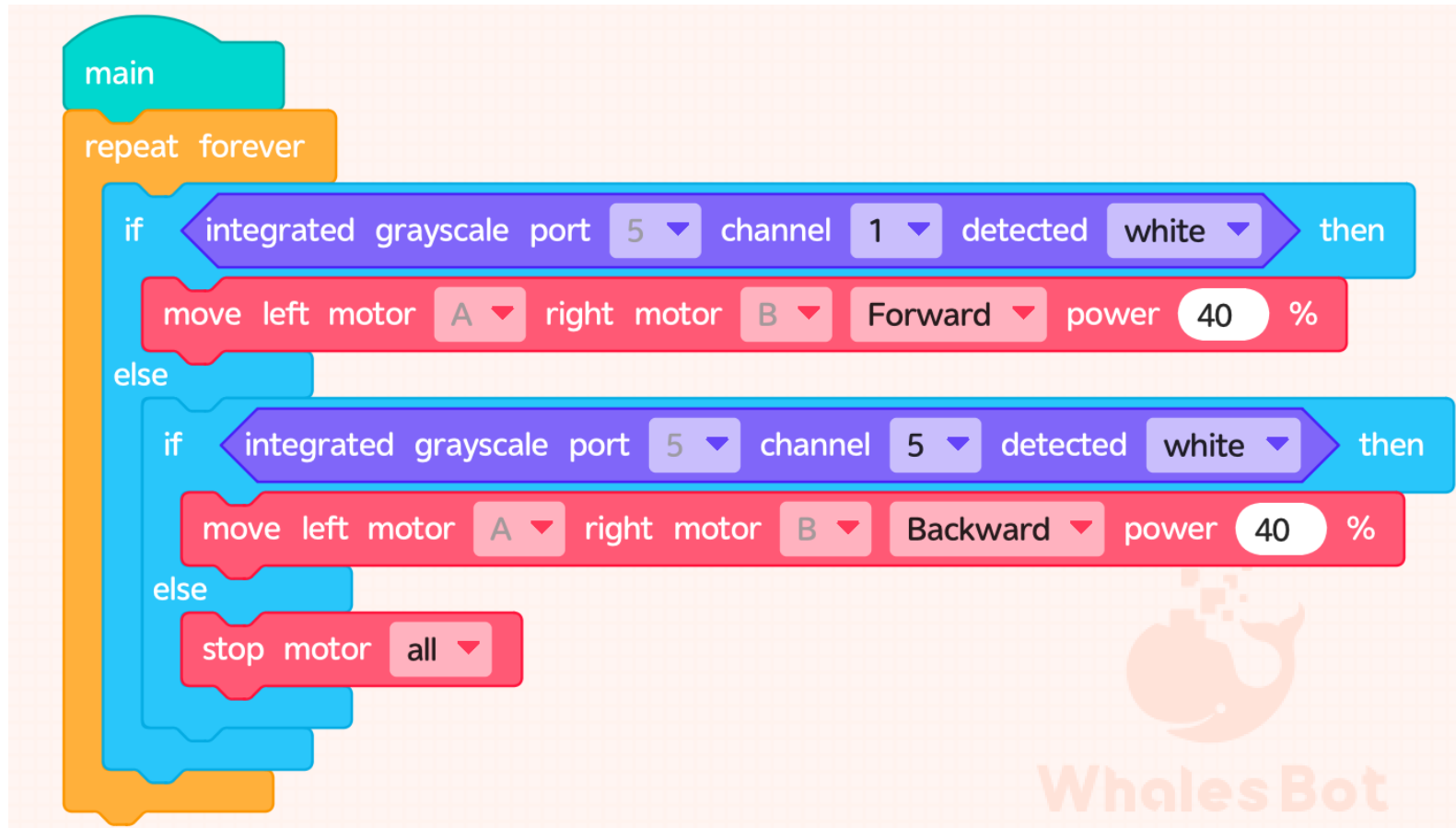
How can the robot make turns upon being touched by hands?

## Experiment 1

Let's try out!



# Experiment 1



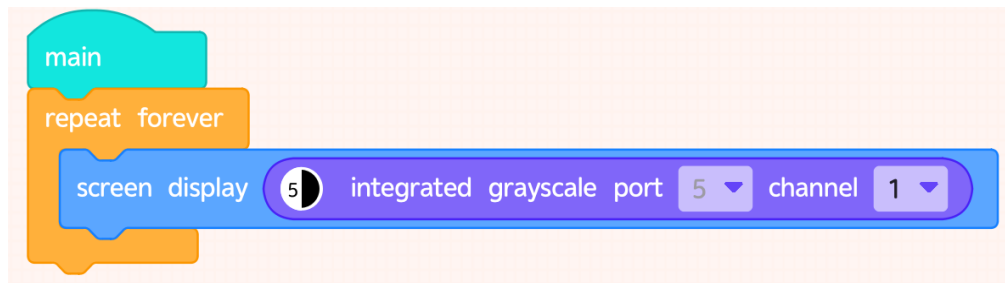
## Experiment 2

### Obtain Grayscale Values



In this experiment, you are going to specify a port and a channel to display grayscale values on the sensor screen.

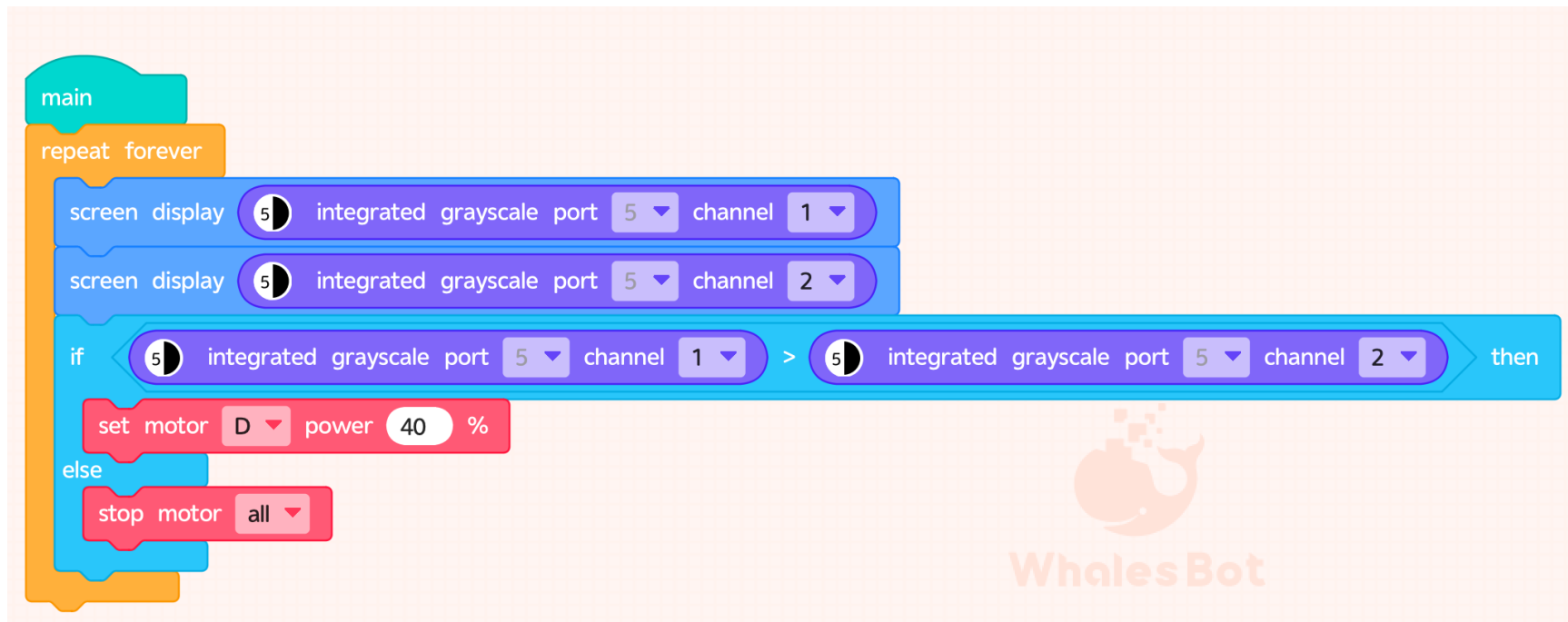
Example:



## Experiment 2

### Obtain Grayscale Values

Example:



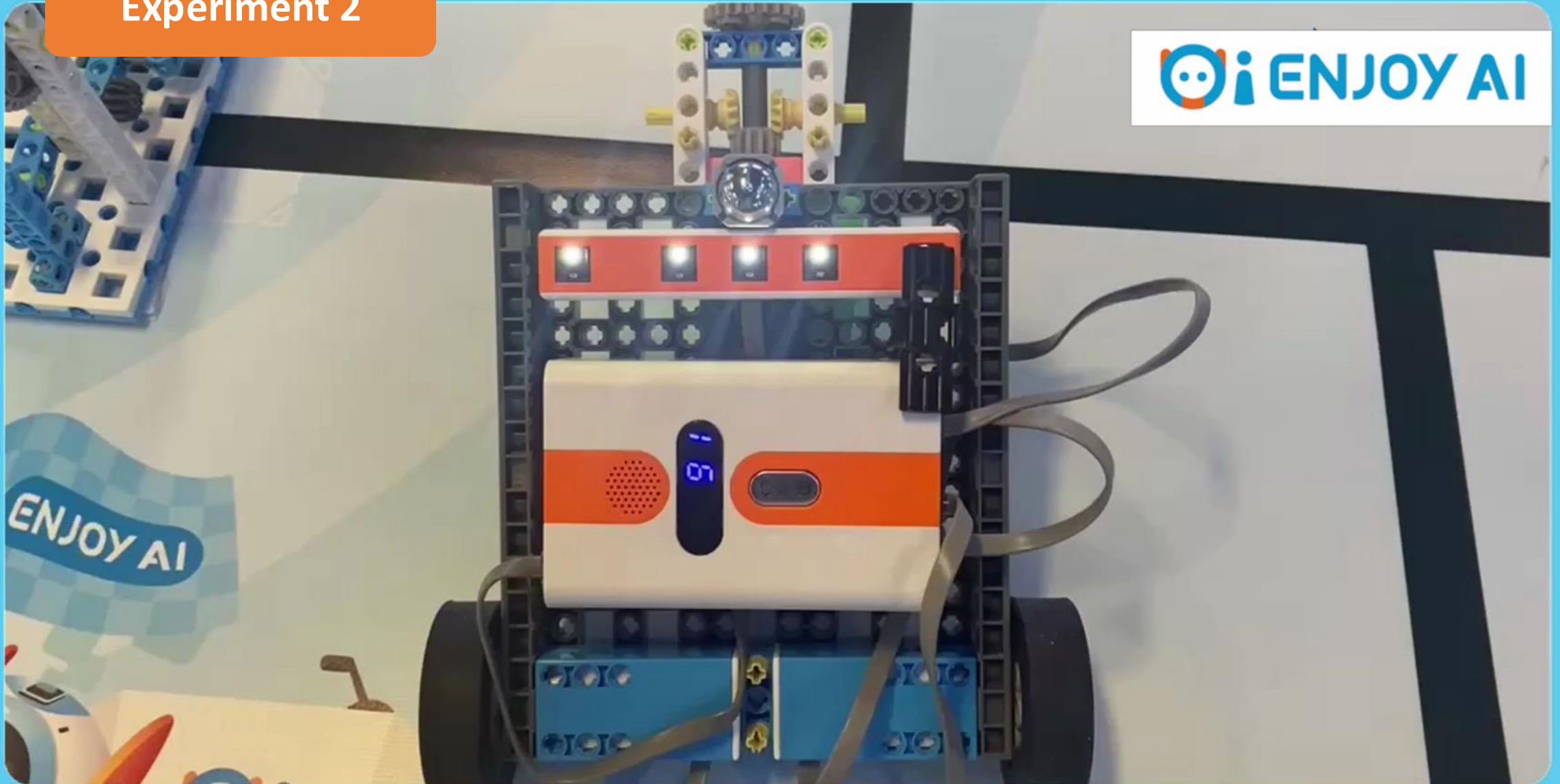
## Experiment 2

**What happens when we start the program?  
Let's watch a video.**



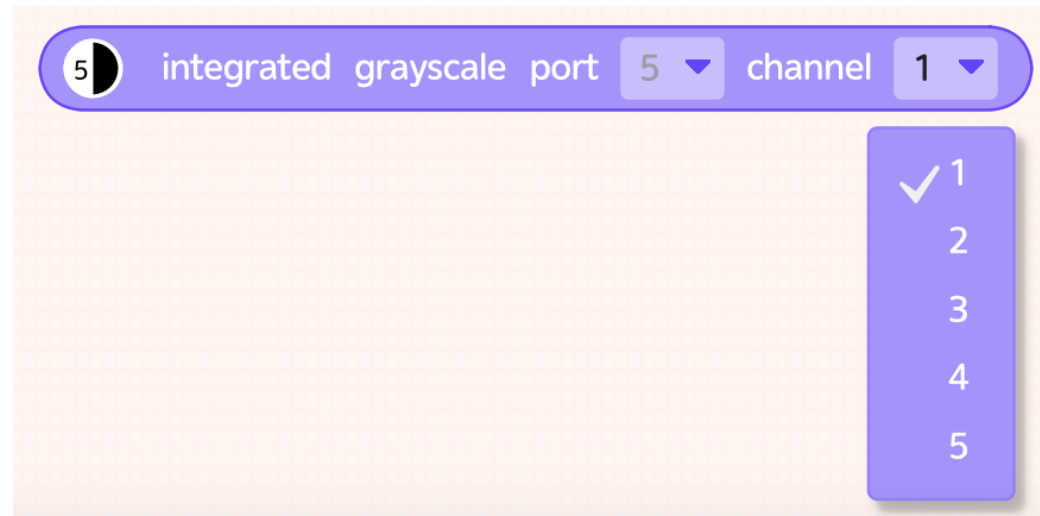
## Experiment 2

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## Experiment 2

### Obtain Grayscale Values



If the grayscale value of Channel 1 is greater than that of Channel 5, the robot turns left.

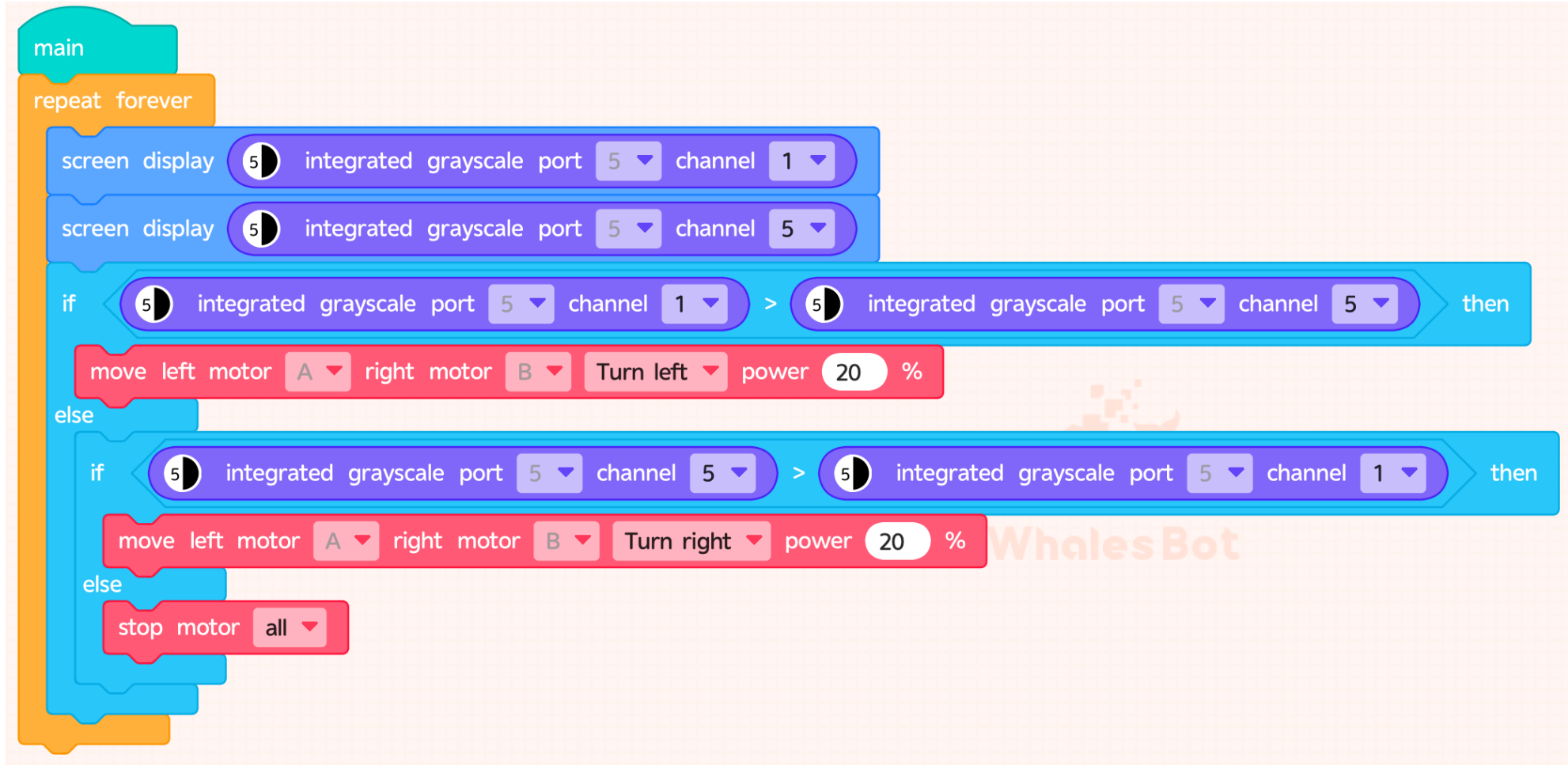
If the grayscale value of Channel 1 is less than that of Channel 5, the robot turns right.

## Experiment 2

**Let's try out !**



## Experiment 2



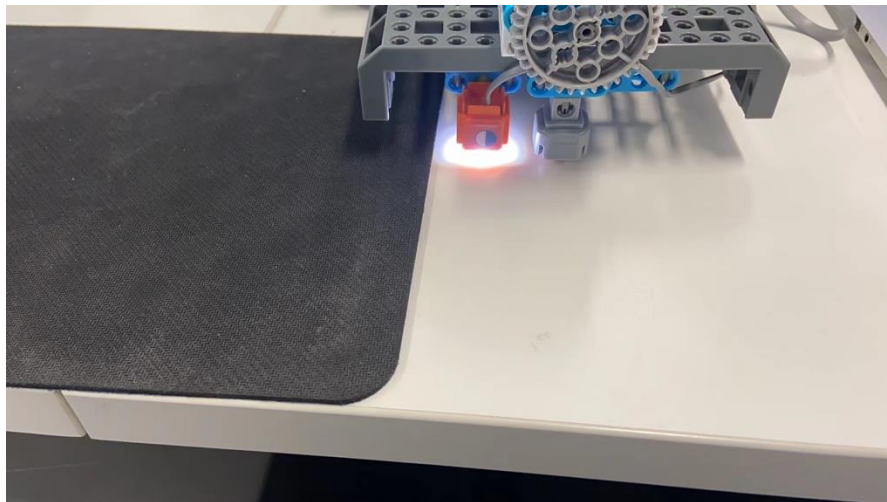
## Experiment 3

### Detect Black Lines Through Single Grayscale

This experiment is different from Experiment 1 only in the grayscale type.

In this experiment, you are going to specify a port and a channel to detect black lines.

single grayscale port 1 ▼ detected black ▼



Single grayscale sensor

## Experiment 3

### Detect Black Lines Through Single Grayscale

Compared with Experiment 1, this experiment ensures simple coding and sufficient room to install sensors.



Sample case: detect whether there is a black line

## Experiment 3

Use One Channel in 5-in-1 Grayscale Sensor



If we do not have single grayscale sensors at hand, what do we do?

## Experiment 3

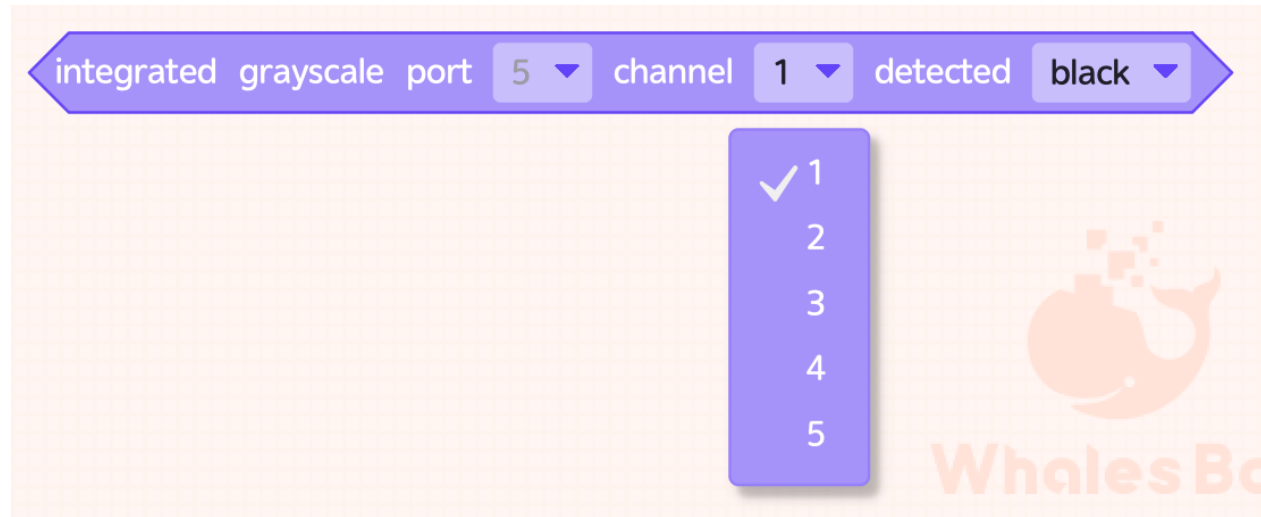
### Use One Channel in 5-in-1 Grayscale Sensor



The 5-in-1 grayscale sensor of WhalesBot is the integration of five single grayscale sensors.

So, you can use only one channel of a 5-in-1 grayscale sensor to replace a single grayscale sensor.

## Experiment 3



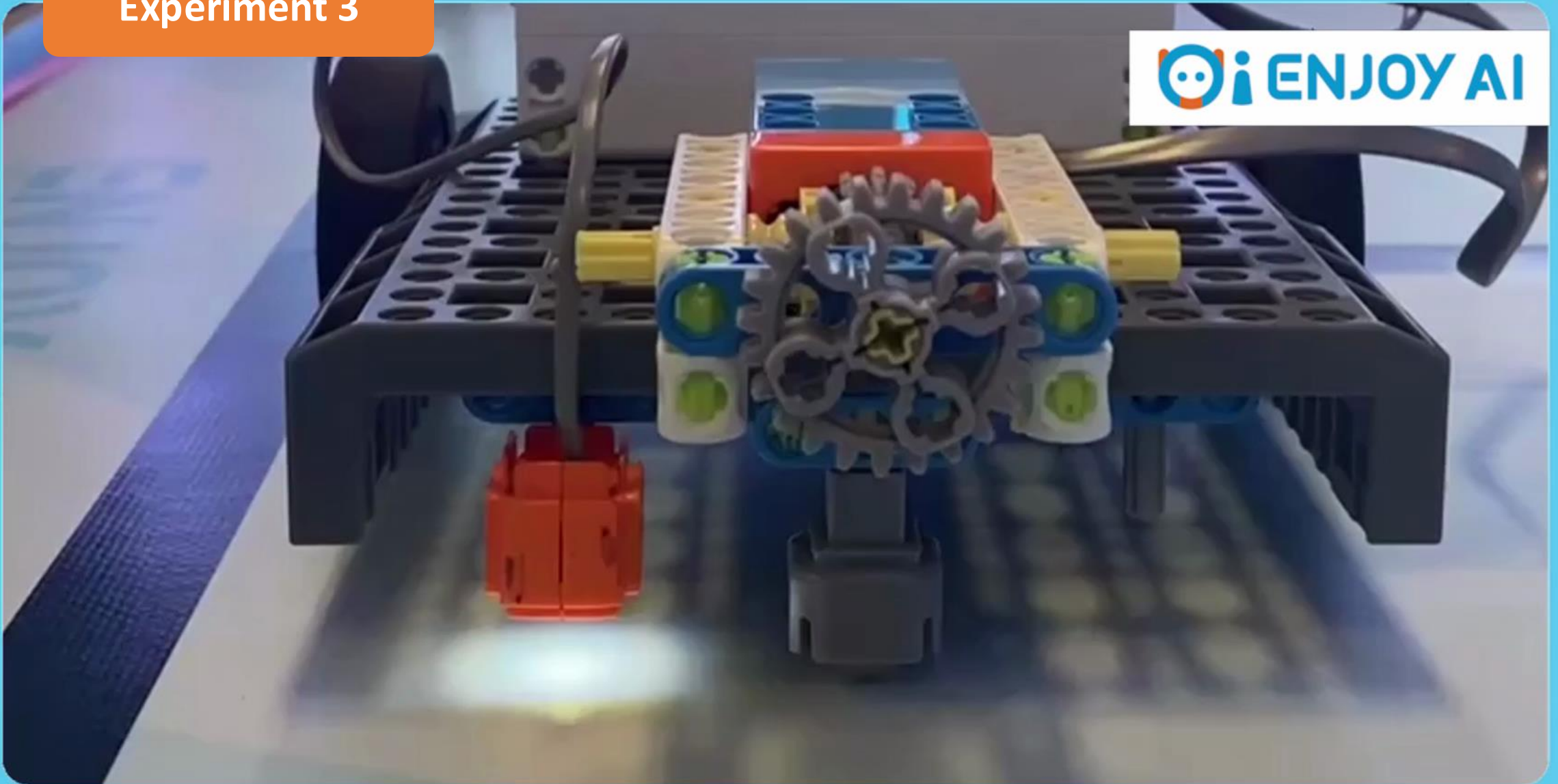
You can use this code block to make motors rotate only if a black line is detected.

## Experiment 3

**Let's watch two videos to better understand the usage of this code block!**



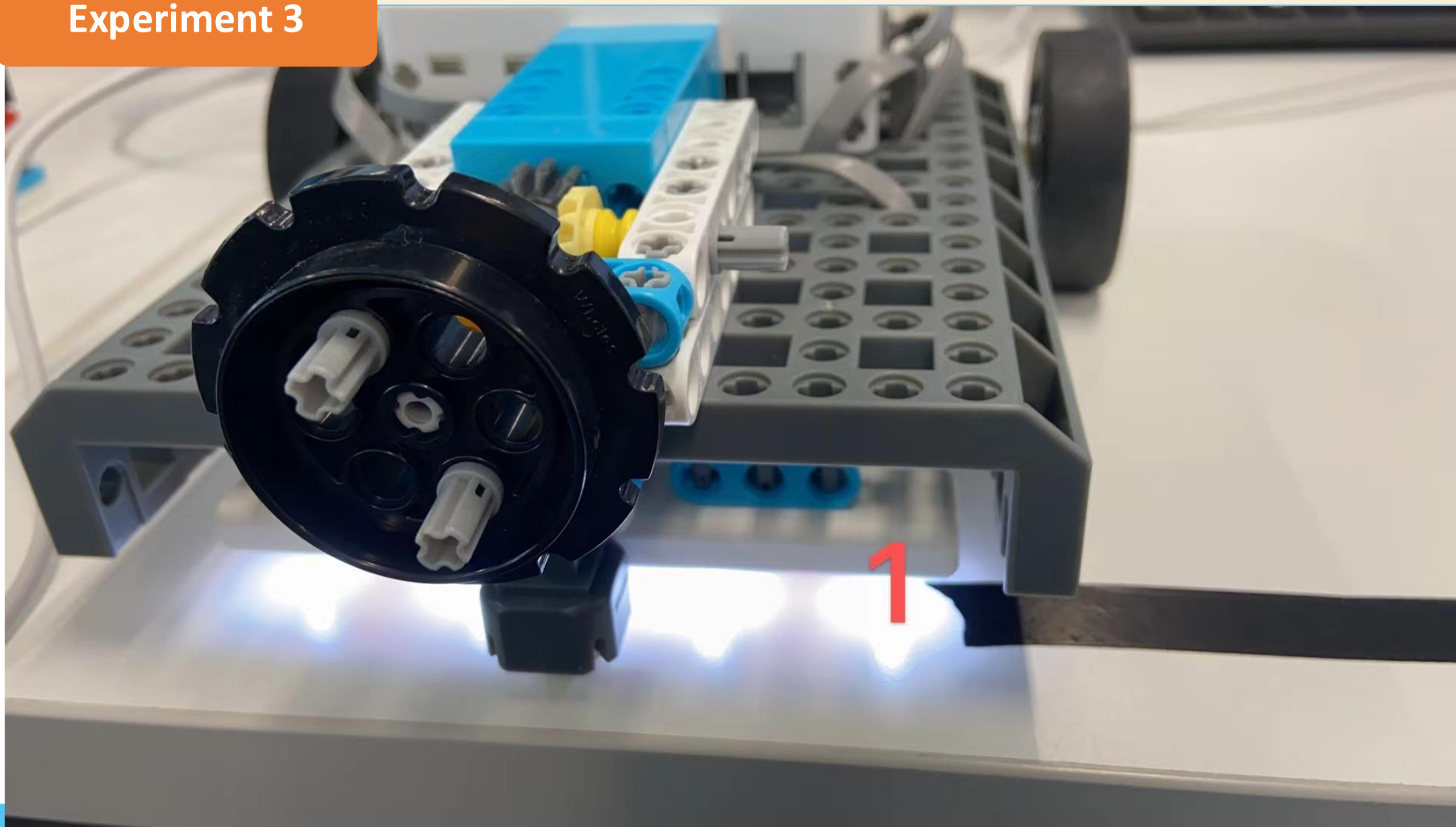
## Experiment 3



### Experiment 3



## Experiment 3

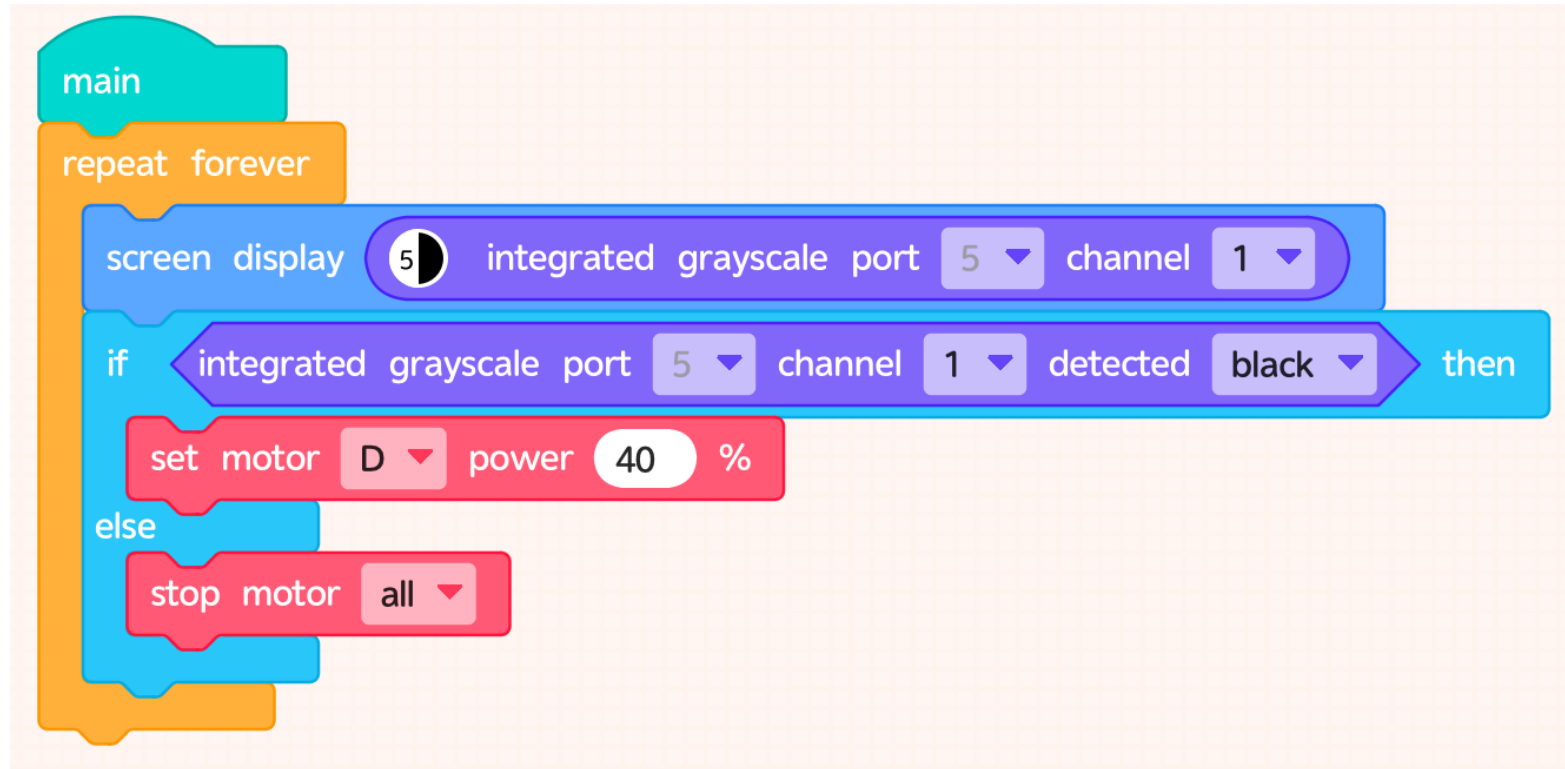


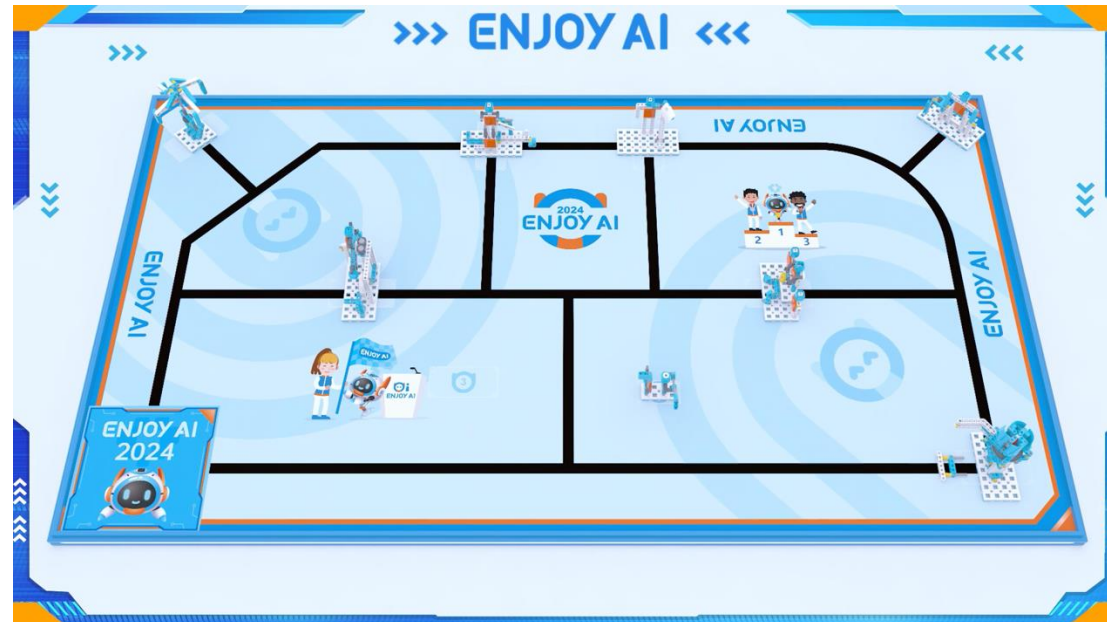
## Experiment 3

**Let's try out!**

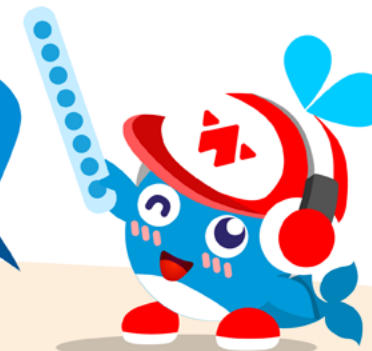


## Experiment 3





After we learn the code blocks about grayscale, let's finish the final task!



# Tasks



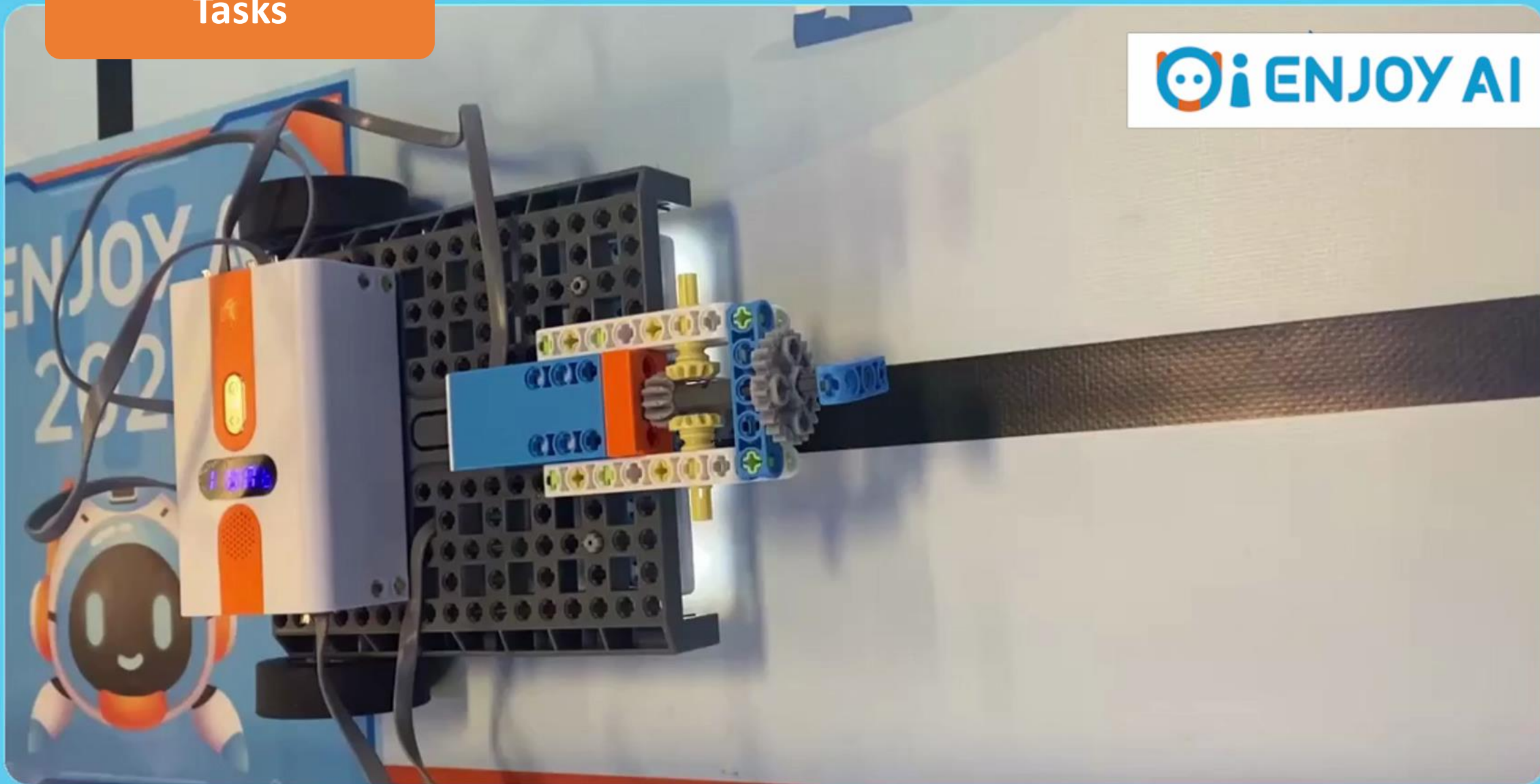
## Tasks

**Put your robot on a black line and complete the task in the following video!**



## Tasks

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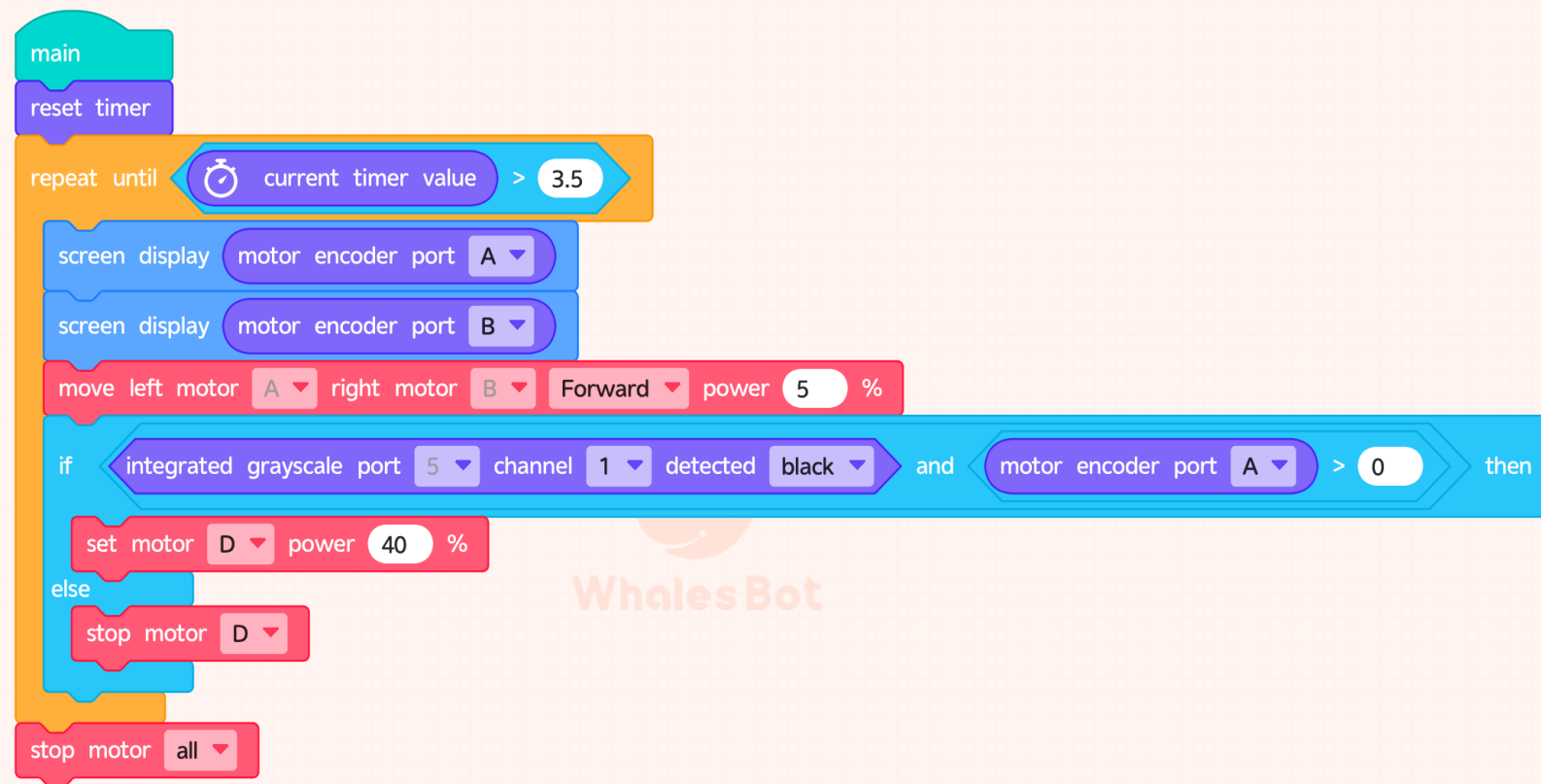


## Tasks

**Run the following program!**



# Tasks



See you next time!

