Dobot Scratch User Guide

Issue: V1.3.1

Date: 2020-01-15

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Preface

Purpose

This manual introduces the use of Scratch, including equipment connection, building blocks, etc., for the convenience of users to understand and use Scratch.

Intended Audience

This document is intended for:

- Customer Engineer
- Sales Engineer
- Installation and Commissioning Engineer
- Technical Support Engineer

Change History

Date	Change Description
2020/01/11	The first release

Symbol Conventions

The symbols that may be founded in this document are defined as follows.

Symbol	Description
⚠DANGER	Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury
⚠WARNING	Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robotic arm damage
⚠NOTICE	Indicates a potentially hazardous situation which, if not avoided, can result in robotic arm damage, data loss, or unanticipated result
🕮NOTE	Provides additional information to emphasize or supplement important points in the main text

Contents

1. Introduction

DobotScratch is a building block programming and code programming software based on the offline version of Scratch 3.0, which not only allows users to create story, game, and animation, etc, but also provide programming instruction for Dobot hardware devices. The devices that DobotScratch supported are Dobot Magician, Dobot Magician Lite, Magic Box, AI-Starter, Mobile Platform, and Arduino. The homepage is shown below.

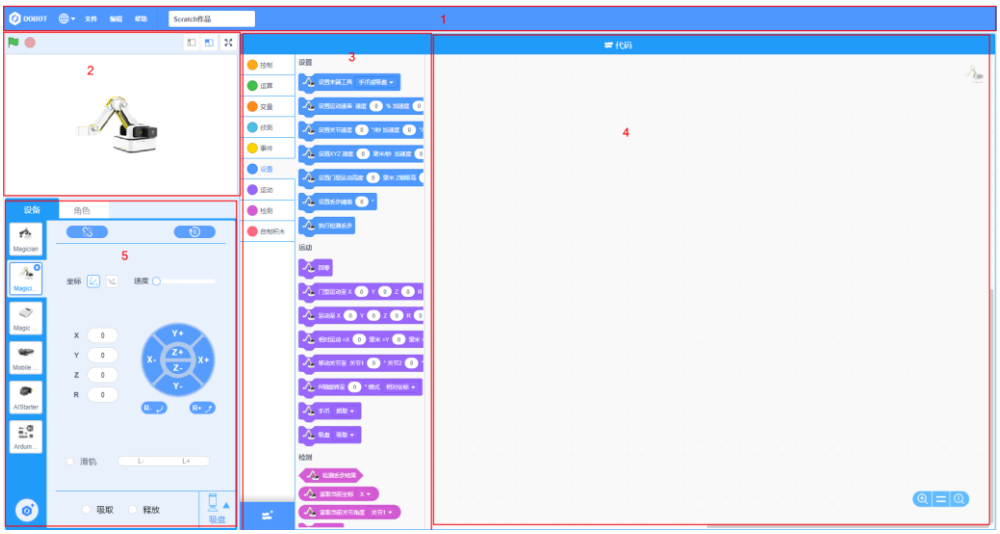


Figure 1.1 Homepage

Table 1.1 Homepage description

No.	Function	Description
1	Menu bar	Change system language, save and upload your works, etc
2	Dance area	Show your work, connect device, set role and background, etc
3	Block area	Provide all blocks
4	Code area	Drag block to this page and edit it.
5	Jogging control area	connection control, motion direction control, end control and slide rail control

2. Devices and Extension Center

We will introduce the device lib and extension center in this chapter, you can click  to view device lib. As shown below.

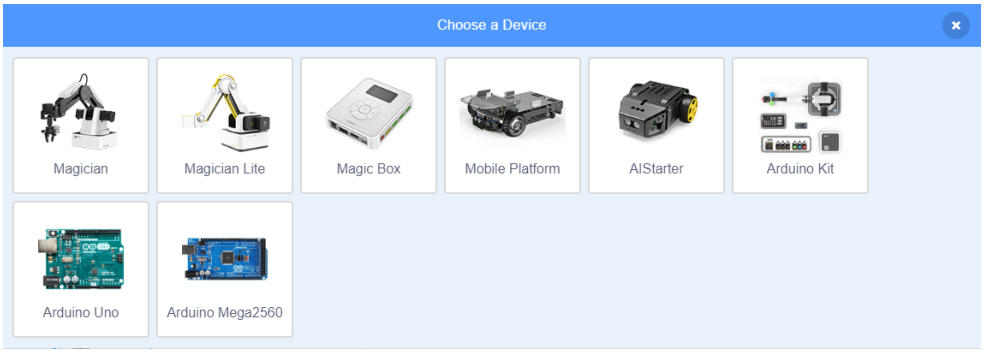


Figure 2.1 device selection

The block area will shown the corresponding instruction after selecting device. You can also click  to add extension device in extension center. As shown below.

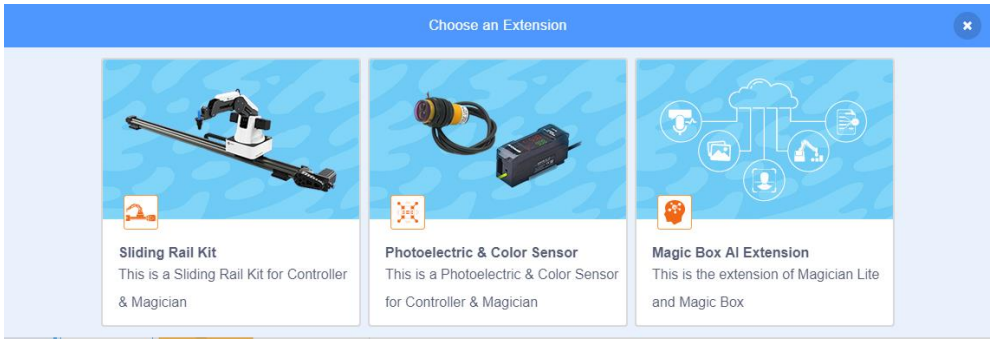


Figure 2.2 extension center

NOTE

One DobotScratch can control multiple devices at the same time.

3. Quick Start

3.1 Device Connection

DobotScratch supports multiple Dobot devices. This section uses Dobot Magician Lite as an example to describe how to connect devices.

Prerequisites

Magician Lite has been connected to PC via USB

Procedure

Step 1 Power on Magician Lite.

Step 2 Click  on DobotScratch into **Choose a Device** interface, where you should select **Magician Lite**.

Step 3 Click  to connect **Magician Lite** on device interface.

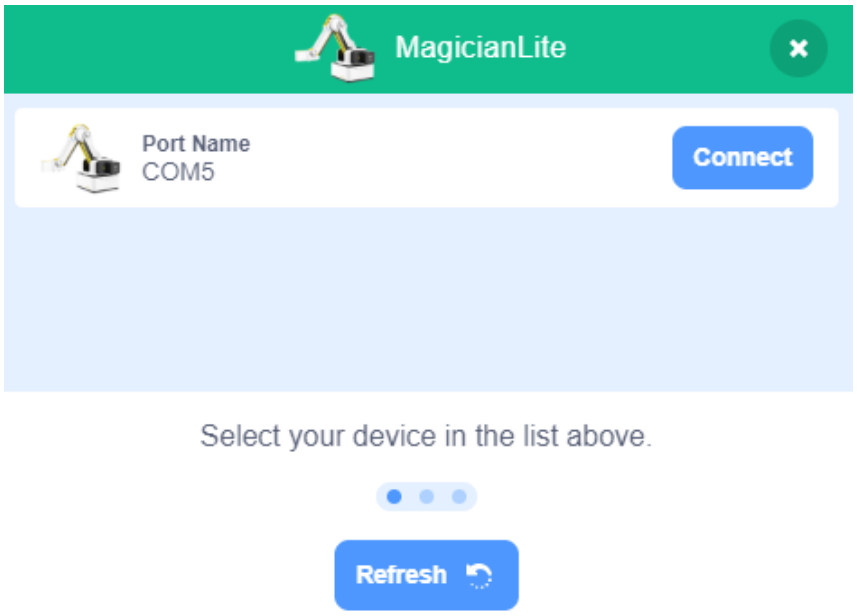
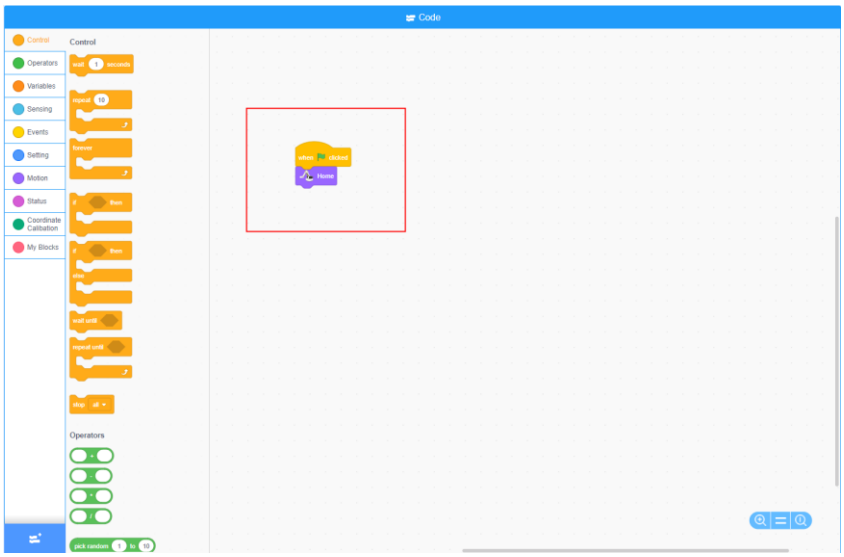


Figure 3.1 Connect Magician Lite and Scratch

Step 4 After connecting Dobot Magciain Lite and DobotScratch successfully, you can drag the blocks in the block area to start programming. As shown in the figure below, click  to home Maigcian Lite.



3.2 Program Upload

DobotScratch supports multiple Dobot devices. This section uses AI-Starter as an example to describe how to upload program to devices.

Prerequisites

AI-Starter has been connected to PC via USB.

Procedure

Step 1 Click  on DobotScratch into **Choose a Device** interface, where you should select **AI-Starter**.

Step 2 Drag the blocks to the block area, as shown below.

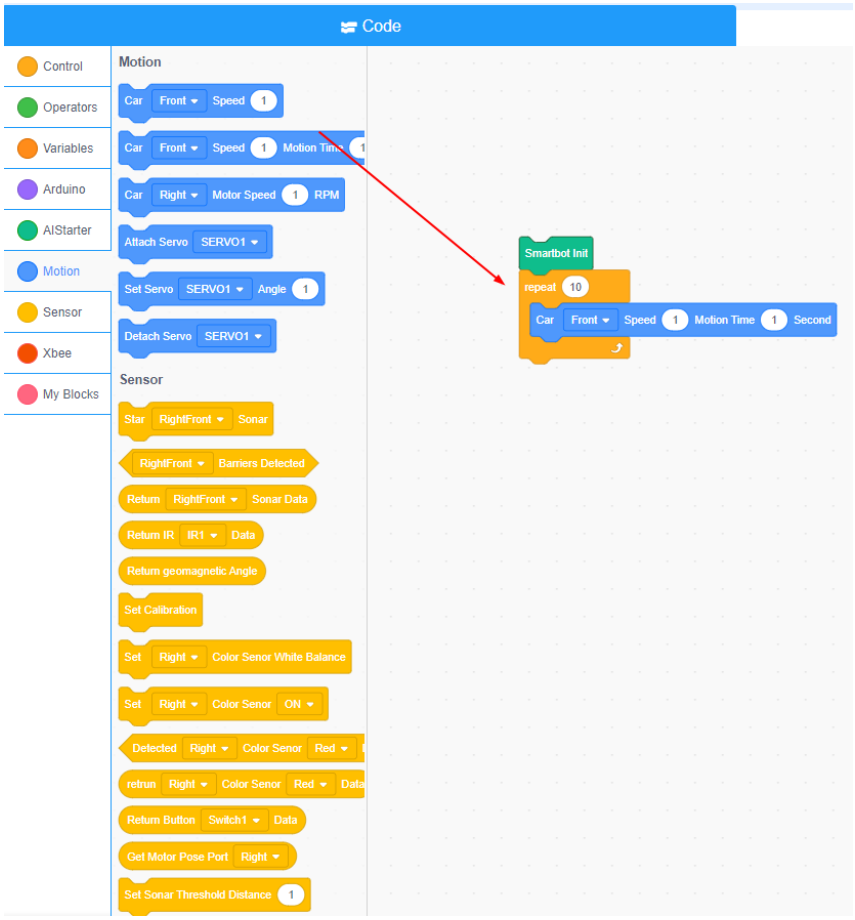


Figure 3.2 Drag blocks to the block area

Step 3 Click  to select the corresponding serial port and click **upload** to upload code. As shown below.

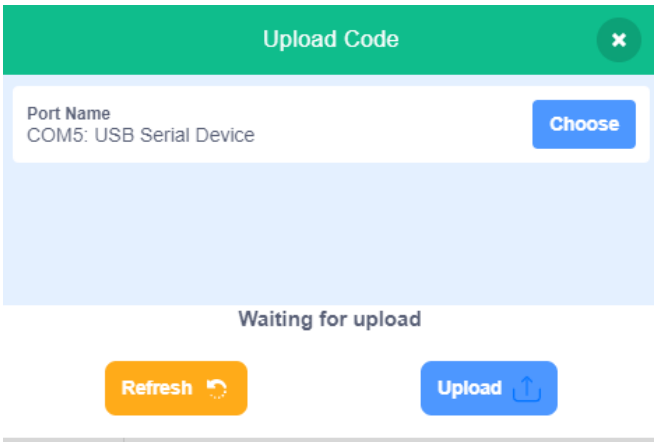


Figure 3.3 select the corresponding serial port to upload code

Power on AI-Starter to perform it after uploading code.

4. Program Instructions

4.1 Maigcian/Magician Lite

4.1.1 Setting

Table 4.1 Select end-tool

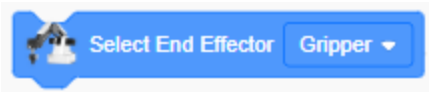
Instruction	
Description	Select end-tool
Parameters	end-tool: • Gripper • Suction cup • Pen
Return	None

Table 4.2 Set PTP motion ratio

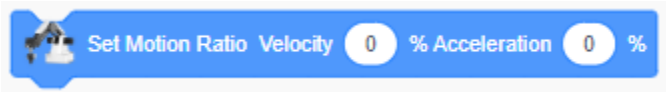
Instruction	
Description	Set motion ratio
Parameter	Speed ratio: Set the speed ratio. Set the speed multiplied by the ratio to the actual speed Acceleration ratio: Set the acceleration ratio. Set the acceleration multiplied by the ratio as the actual acceleration
Return	None

Table 4.3 Set the speed and acceleration of the joint axis

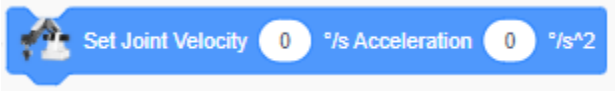
Instruction	
Description	Set the speed and acceleration of the joint axis
Parameter	Speed: Set the speed of each joint coordinate axis Acceleration: Set the acceleration of each joint coordinate axis
Return	None

Table 4.4 Set the speed and acceleration of the Cartesian axis

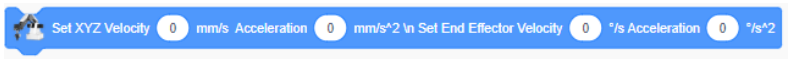
Instruction	
Description	Set the speed and acceleration of the Cartesian axis
Parameter	Speed: Set the Cartesian axis speed Acceleration: Set acceleration of Cartesian axis
Return	None

Table 4.5 Set the stepper motor speed

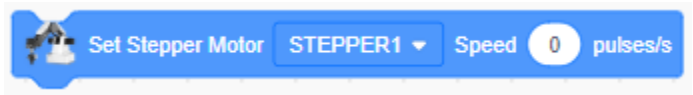
Instruction	
Description	Set the stepper motor speed. (This block is only supported by Magician)
Parameter	Motor: Select the motor first Speed: motor speed (puls/s)
Return	None

Table 4.6 Set the height of the lift in Jump mode and the height limit of the Z axis

Instruction	
Description	Set the height of the lift in Jump mode and the height limit of the Z axis
Parameter	Height: set the door height Z-axis height limit: Set the Z-axis height limit
Return	None

Table 4.7 Set lost step threshold

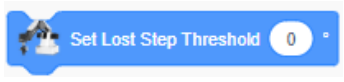
Instruction	
Description	Set a lost step detection threshold to detect whether the positioning error exceeds the threshold. If the threshold is exceeded, the motor lost steps
Parameter	Parameter setting: set cutting value
Return	None

Table 4.8 Set the number of stepper motor speed pulses

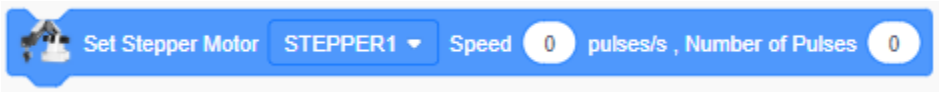
Instruction	
Description	Set the number of stepper motor speed pulses. (This block is only supported by Magician)
Parameter	Motor: Select motor Speed: Set the motor speed (puls/s) Pulse number: set the number of motor pulses
Return	None

Table 4.9 Perform motor loss detection

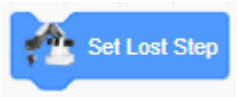
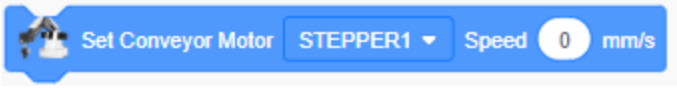
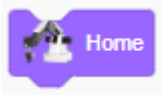
Instruction	
Description	Perform motor loss detection
Parameter	None
Return	None

Table 4.10 Set the convert motor speed

Instruction	
Description	Set the conveyor motor speed (this block is only supported by Magician)
Parameter	Motor: Select motor Speed: Set the motor speed
Return	None

4.1.2 Motion

Table 4.11 Home robot

Instruction	

Description	Home robot
Parameter	None
Return	None

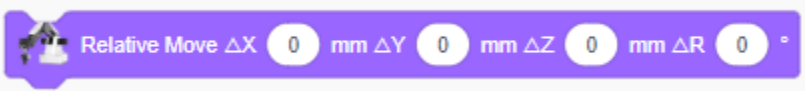
Table 4.12 Robot moves to a set target point in jump mode

Instruction	
Description	Robot moves to a set target point in jump mode
Parameter	X: Set the X coordinate value Y: set the Y coordinate value Z: Set the Z coordinate value R: Set the R coordinate value
Return	None

Table 4.13 The robot moves to the set target position with a certain type of motion

Instruction	
Description	The robot moves to the set target position with a certain type of motion
Parameter	X: Click the edit box to set the X coordinate value Y: Set Y coordinate value Z: Set the Z coordinate value R: Set the R coordinate value Movement type: • Joint • Straight Line
Return	None

Table 4.14 Robot moves a relative Cartesian coordinate increment

Instruction	

Description	Robot moves a relative Cartesian coordinate increment
Parameter	△ X: set x increment value △ Y: set y increment value △ Z: set z increment value △ R: set r increment value
Return	None

Table 4.15 Robot moves to the set joint target position

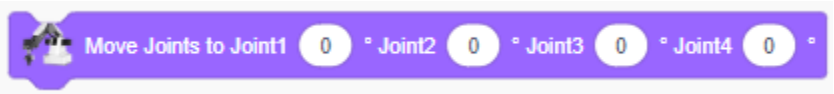
Instruction	
Description	Robot moves to the set joint target position
Parameter	Joint 1: Set the angle of Joint 1 Joint 2: Set the angle of Joint 2 Joint 3: Set the angle of joint 3 Joint 4: Set the angle of joint 4
Return	None

Table 4.16 Set R axis rotation angle

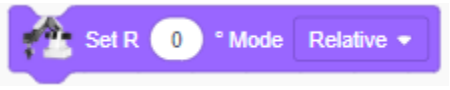
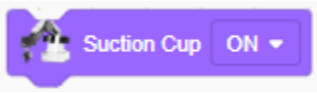
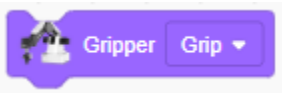
Instruction	
Description	Set R axis rotation angle
Parameter	R-axis angle: set rotation angle Mode: • Relative: Relative coordinate • Absolute: Absolute coordinate
Return	None

Table 4.17 Set suction cup switch

Instruction	
Description	Set suction cup switch

Parameter	Suction cup status: • ON • OFF
Return	None

Table 4.18 Set gripper status

Instruction	
Description	Set gripper status
Parameter	Gripper status: • Grip • Release • Off
Return	None

4.1.3 Detection

Table 4.19 Get real-time robot coordinates

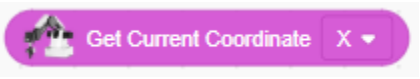
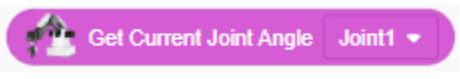
Instruction	
Description	Get real-time robot coordinates
Parameter	Axis： • X • Y • Z • R
Return	Coordinate value

Table 4.20 Get real-time joint angle of robotic arm

Instruction	
Description	Get real-time joint angle of robotic arm

Parameter	Joint： • Joint 1: Set the angle of Joint 1 • Joint 2: Set the angle of Joint 2 • Joint 3: Set the angle of joint 3 • Joint 4: Set the angle of joint 4
Return	Return joint angle

Table 4.21 Detect Robot lost step results

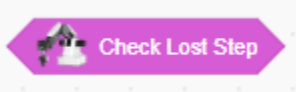
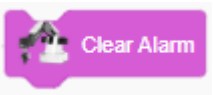
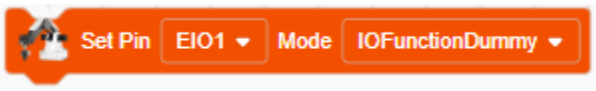
Instruction	
Description	Detect Robot lost step results
Parameter	None
Return	True: step lost False: no step lost

Table 4.22 clearthe robot alarm

Instruction	
Description	Clear robot alarm
Parameter	None
Return	None

4.1.4 I/O（Only Magician supported）

Table 4.23 Set EIO state

Instruction	
Description	Set EIO state

Parameter	EIO: Select IO address according to function type Function type: • IOFunctionDummy • IOFunctionDO • IOFunctionDI • IOFunctionPWM • IOFunctionADC • IOFunctionDIPU • IOFunctionDIPD
Return	None

Table 4.24 Set PWM output

Instruction	
Description	Set PWM output
Parameter	EIO: Select IO address Frequency: Set the frequency. Value range: 10HZ ~ 1MHZ Duty Cycle: Set the duty cycle. Value range: 0 ~ 100
Return	None

Table 4.25 Set digital output to high or low

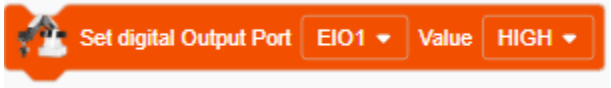
Instruction	
Description	Set digital output to high or low
Parameter	EIO: Select EIO address Value: high or low
Return	None

Table 4.26 Read the value of a digital signal

Instruction	

Description	Read the value of a digital signal
Parameter	EIO：Select EIO
Return	0：low level；1：high level

Table 4.27 Read the value of an analog signal

Instruction	
Description	Read the value of an analog signal
Parameter	EIO：Select EIO
Return	0：low level；1：high level

4.1.5 Calibration (Only Magician Lite supported)

If Magician Lite is required for precise positioning and grasping, coordinate calibration is required in advance. The calibration steps are as follows.

Step 1 Click “Coordinate Calibration” to pop up the calibration interface, follow the prompts to install the suction cup, and click **Next**.

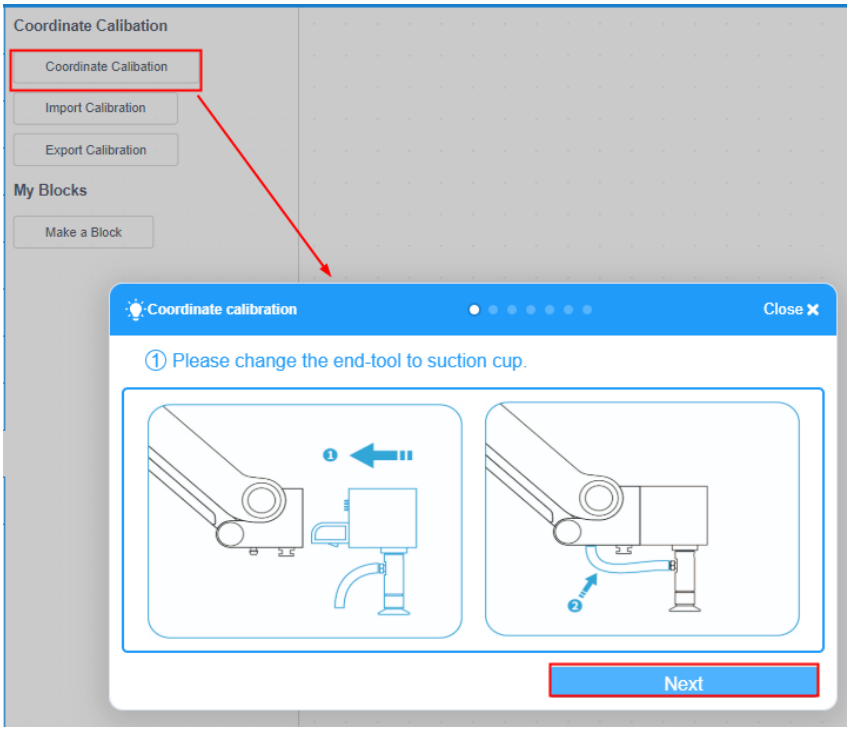


Figure 4.1 Install suction cup

Step 2 Follow the prompts to place the device. Click **Next**.

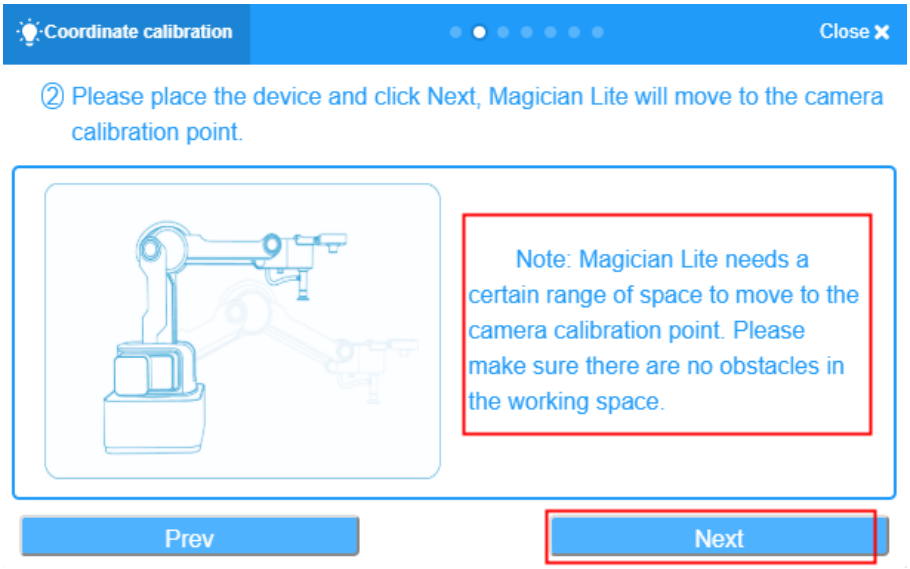


Figure 4.2 Place Magician Lite

Step 3 After placing the calibration plate in the box under the camera according to the prompts, the four calibration points A, B, C, and D will be displayed in the figure. Click **Next**.

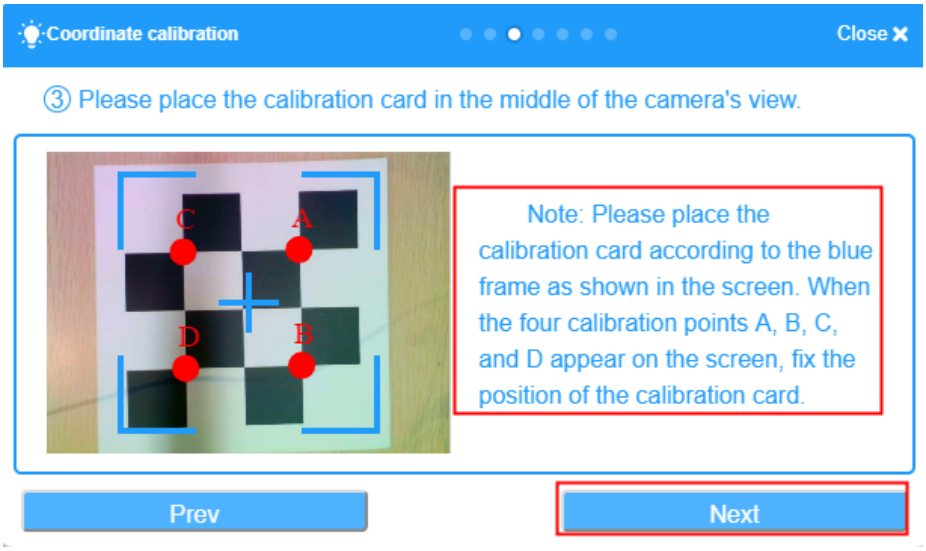


Figure 4.3 Place calibration plate

Step 4 Follow the prompts to jog the robot arm to move the end suction cup to the calibration point A, and click **Next**.

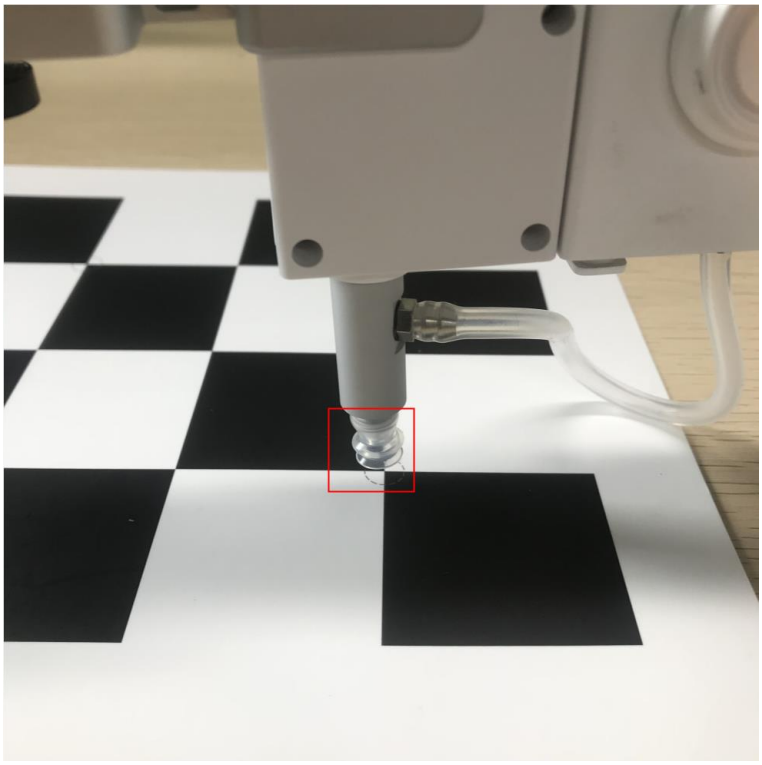


Figure 4.4 Move the end suction cup to the calibration point A

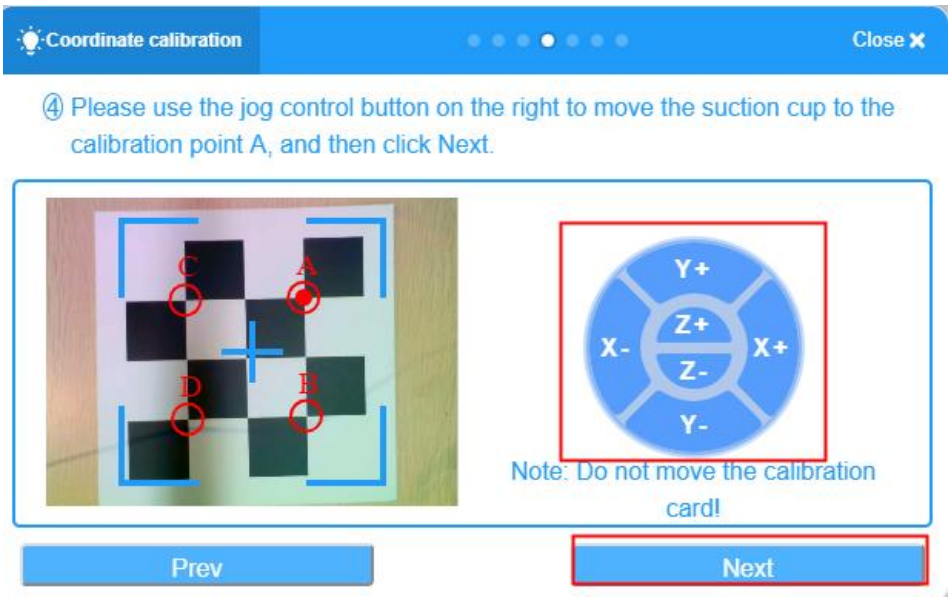


Figure 4.5 Calibration point A

📖NOTE

Do not move the calibration plate during the calibration process, otherwise the calibration will be invalid.

Step 5 Follow step 4 to calibrate point B, point C and point D.

4.2 Extension Device

4.2.1 Sliding rail

Table 4.28 Set sliding rail state

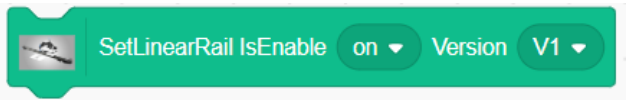
Instruction	
Description	Set Sliding rail status
Parameter	Status: Click the drop-down box to set the status Version: Click the drop-down box to select the corresponding version of the sliding rail
Return	None

Table 4.29 Get sliding rail state

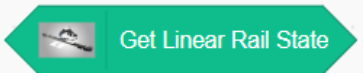
Instruction	
Description	Get Sliding rail state
Parameter	None
Return	None

Table 4.30 Move the sliding rail for a certain distance

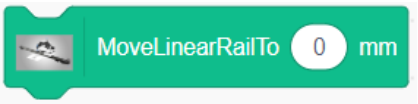
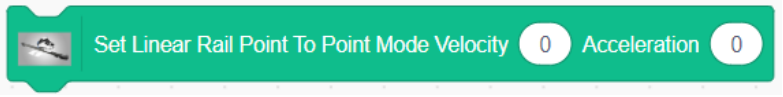
Instruction	
Description	Move the sliding rail for a certain distance
Parameter	Distance: Set the moving distance of the sliding rail
Return	None

Table 4.31 Set the speed and acceleration in PTP mode

Instruction	

Description	Set the speed and acceleration in PTP mode
Parameter	Speed: Set the speed of the sliding rail Acceleration: Set the acceleration of the sliding rail
Return	None

Table 4.32 Set the speed and acceleration in jogging mode

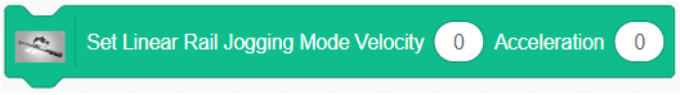
Instruction	
Description	Set the speed and acceleration in jogging mode
Parameter	Speed: Set the speed of the sliding rail Acceleration: Set the acceleration of the sliding rail
Return	None

Table 4.33 Get the speed and acceleration in PTP mode

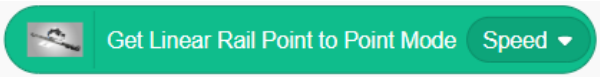
Instruction	
Description	Get the speed and acceleration in PTP mode
Parameter	Select the parameter speed (mm / s) or acceleration (mm / s²)
Return	Speed or acceleration

Table 4.34 Get the speed and acceleration in jogging mode

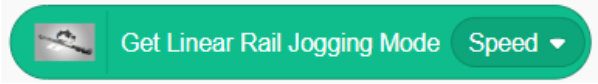
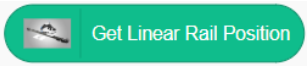
Instruction	
Description	Get the speed and acceleration in jogging mode
Parameter	Select the parameter speed (mm/s) or acceleration (mm/s²)
Return	Speed or acceleration

Table 4.35 Get sliding rail postion

Instruction	

Description	Get sliding rail position
Parameter	None
Return	Sliding rail position（mm）

4.2.2 AI

Speech Recognition

Speech Recognition

Step 1 Click **Open speech recognition** popup the voice recognition interface.

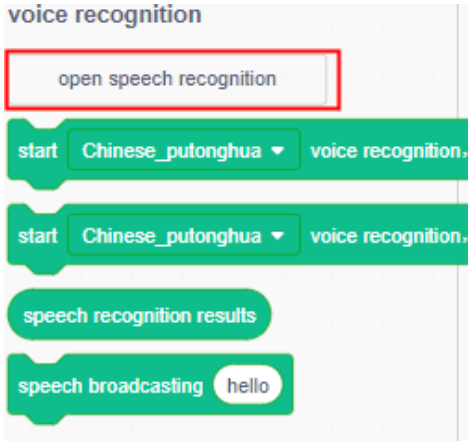


Figure 4.6 Open speech recognition

Step 2 Please select a language，Click **Start** to recognize your voice.

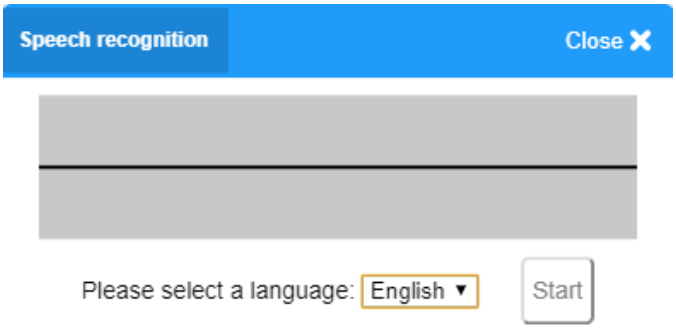


Figure 4.7 Start recognition

Step 3 Click **Stop** to finish speech recognition.

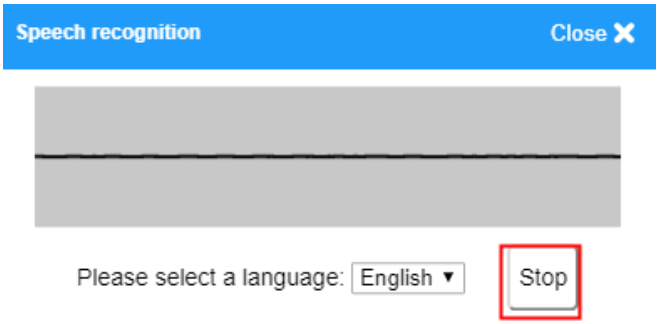


Figure 4.8 Stop recognition

Step 4 Close this interface, and the recognition result will be saved to Speech recognition results module  .

Instruction Description

Table 4.36 Recognize speech automatically

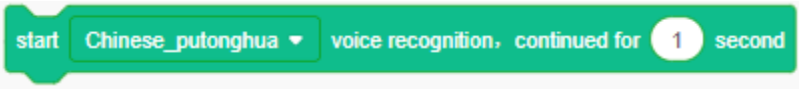
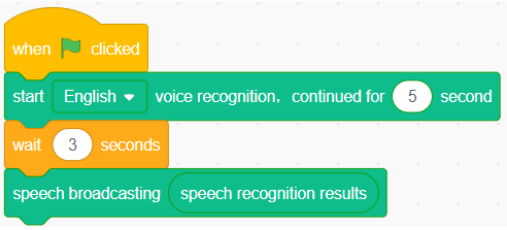
Instruction	
Description	Recognize speech automatically
Parameter	Select language：select language to **Chinese_putonghua** or **English** Time：set speech recognition time
return	None
Example	Click  to execute program. Say something for 5s, wait for 3s to broadcast speed result. 

Table 4.37 Recognize speech manually

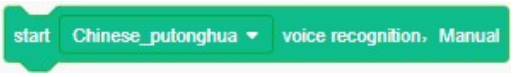
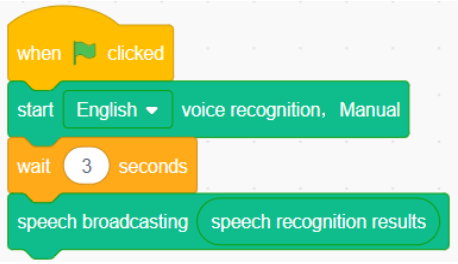
Instruction	
Description	Recognize speech manually
Parameter	Select language：select language to **Chinese_putonghua** or **English**
return	Nome
Example	Click  to xexcute program. Click **Start** to say something, when you finish speaking, click **Stop**, wait for 3s to broadcast speed result. 

Table 4.38 Speech recognition result

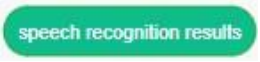
Instruction	
Description	speech recognition will be saved in this module
Parameter	None
return	Speech recognition
Example	Please refer to Table 4.36

Table 4.39 broadcast speech

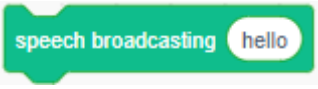
Instruction	
Description	Broadcast speech
Parameter	Set speech that need to broadcast
return	None
Example	Please refer to Table 4.36

Image Getting

Table 4.40 Get image automatically

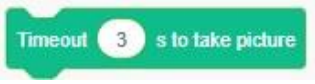
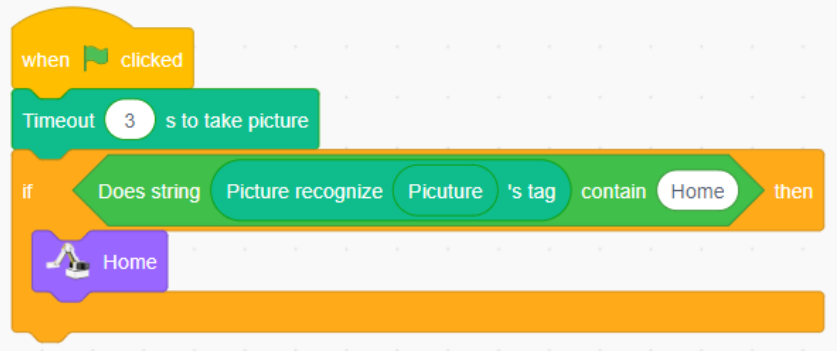
Instruction	
Description	Get image automatically
Parameter	Set time to get image
return	None
Example	Click  and the camera will take a picture after 3s, if the picture's tag contains **Home**, the Robot will execute home function. 

Table 4.41 Get image manually

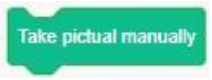
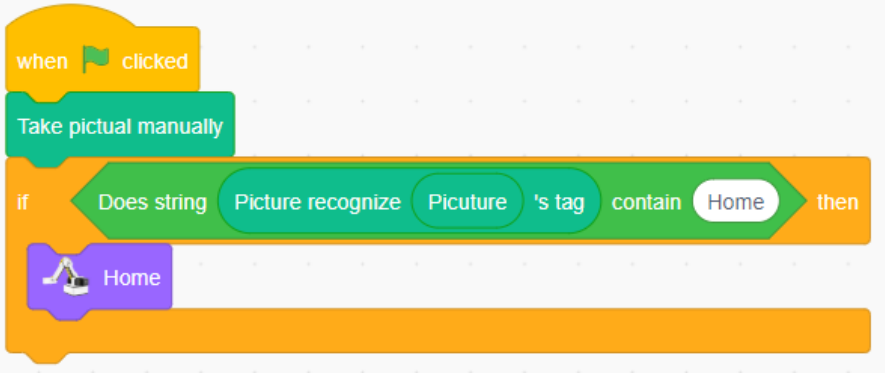
Instruction	
Description	Get image manually
Parameter	None
return	None
Example	Click  and click **take a picture**, if the picture's tag contains **Home**, the Robot will execute home function 

Table 4.42 Save image

Instruction	Picuture
Description	An image will be saved in this module
Parameter	None
return	Image
Example	Please refer to Table 4.41

Image Recognition

Create Image Date

Step 5 Click **Edit classification data** to popup create image date interface.

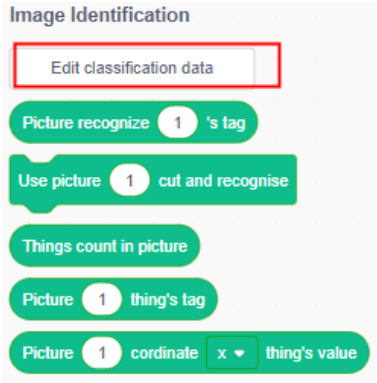


Figure 4.9 Edit classification data

Step 6 Click  to get image and name it. (please colse your computer camera before using camera)

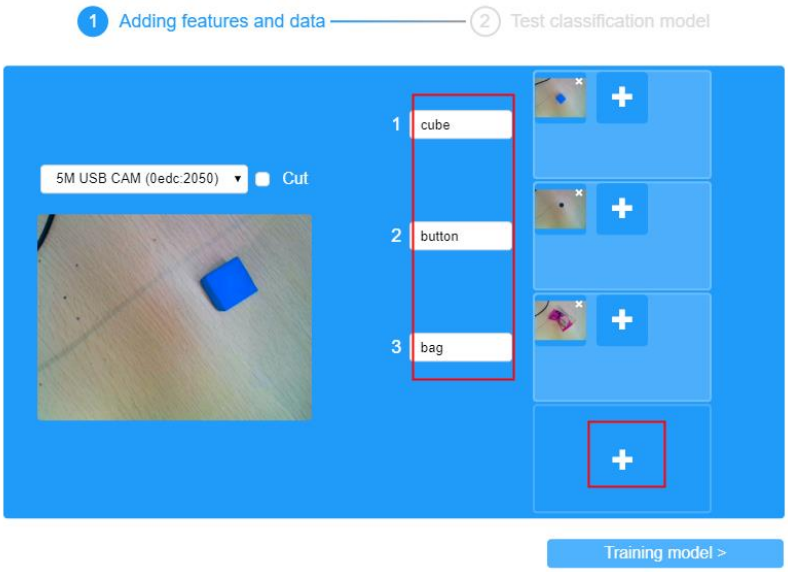


Figure 4.10 Get image and name it

Step 7 If you need to cut the object in the picture, you can check **Cut** and click the object in the box to get the picture.

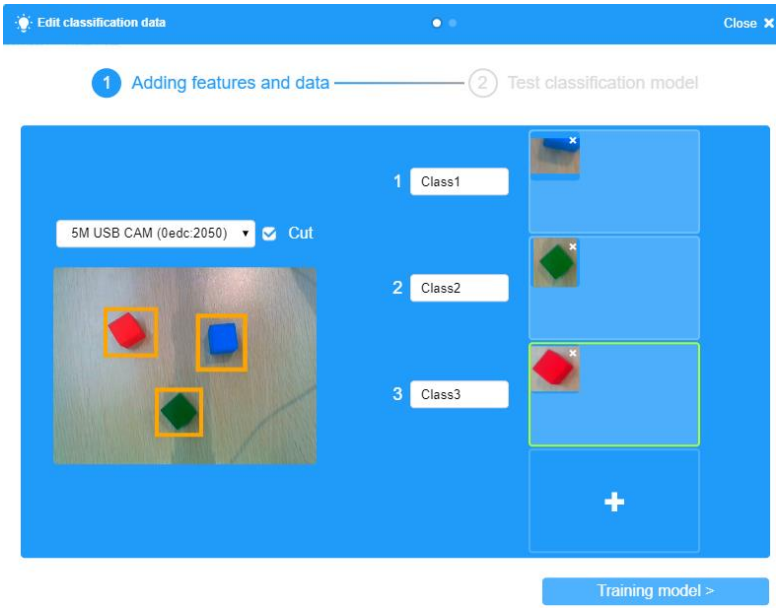


Figure 4.11 Cut picture

Step 8 Click **Training model** to test image, put object below the camera, and the system will match it via feature.

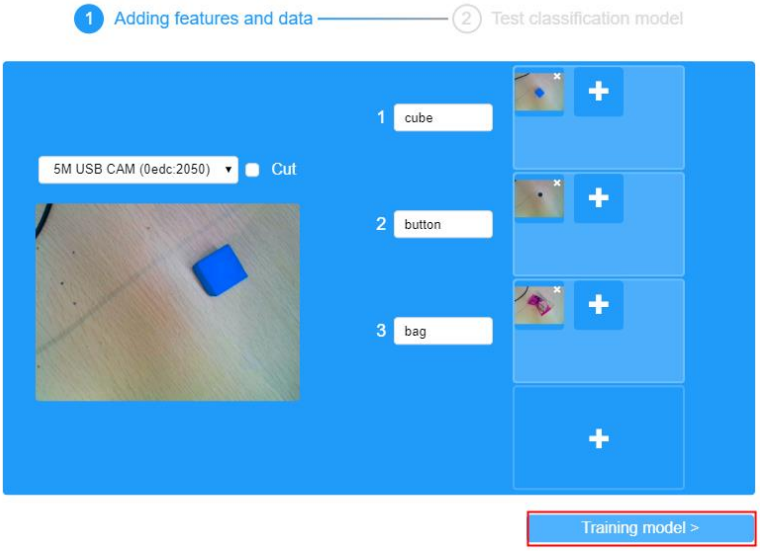


Figure 4.12 Training model

Step 9 Click **Finish** to finish creating image after finish image testing.

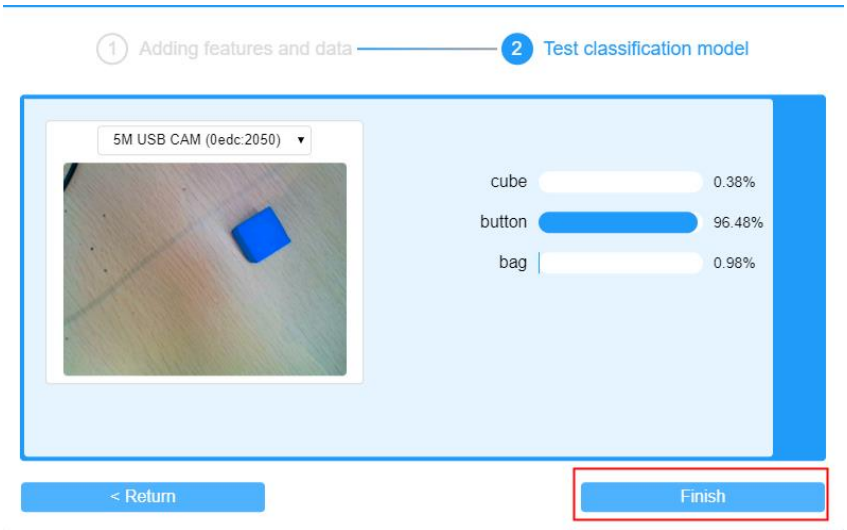


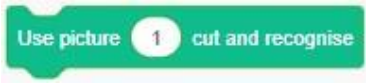
Figure 4.13 Finish model

Instruction Description

Table 4.43 Image name recognition

Instruction	
Description	Recognize image name
Parameter	Put an image into the module
return	Image name
Example	Please refer to Table 4.40

Table 4.44 Cut and recognize image

Instruction	
Description	Cut and recognize image
Parameter	Put an image into the module
return	None
Example	Click **space** key to execute program. If picture's tag is **home**, get coordinate value and to make robot execute home function

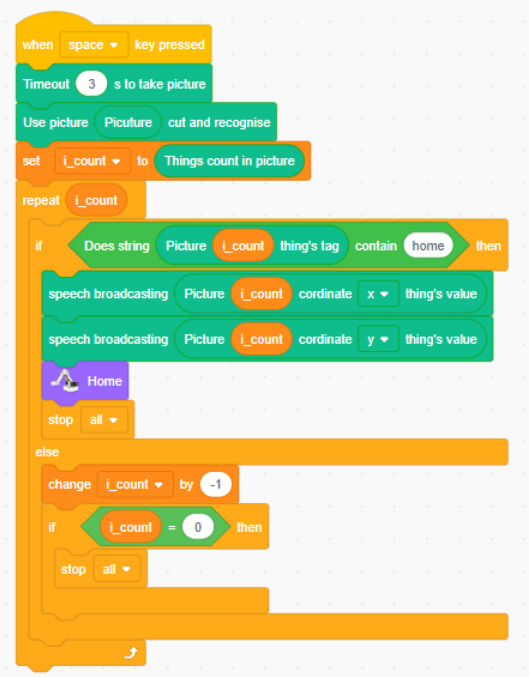
	

Table 4.45 Get the number of image which is cut

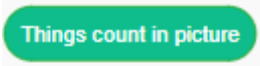
Instruction	
Description	Get the number of image which is cut
Parameter	None
return	Image number
Example	Please refer to Table 4.44

Table 4.46 Get number of picture which is cut

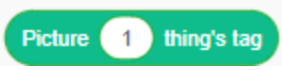
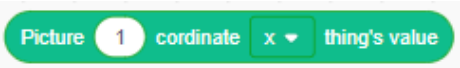
Instruction	
Description	Get number of picture which is cut
Parameter	Picture number：set cut picture number
return	name
Example	Please refer to Table 4.44

Table 4.47 Get coordinate of picture

Instruction	
Description	Get coordinate of picture which is cut
Parameter	Picture number：set cut picture number coordinate：select axis
return	Coordinate value
Example	Please refer to Table 4.44

Face Recognition

Create Face Date

Step 1 Click **New face data** topopup the create face date interface.

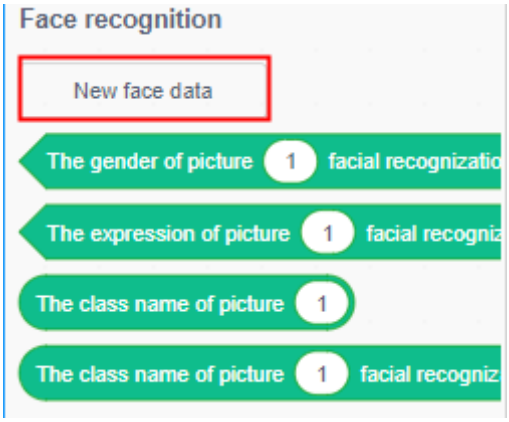


Figure 4.14 Create face data

Step 2 Click  to get face data and name it.

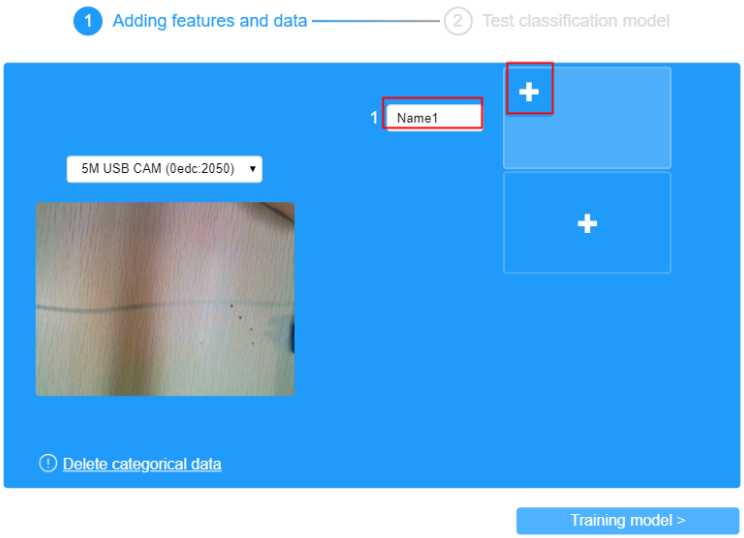


Figure 4.15 Get face data and name it

Step 3 Click **Training model** to test face date

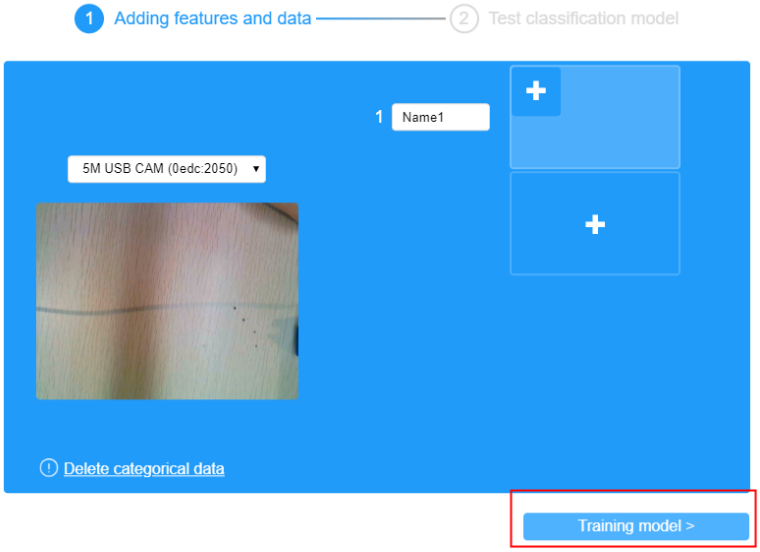


Figure 4.16 Training model

Step 4 Put your face below the camera, and click **Test** to match it via feature.

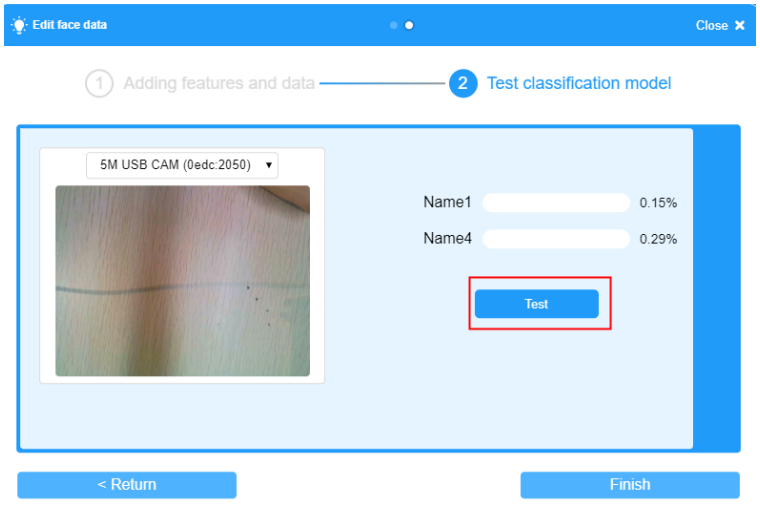


Figure 4.17 Train model

Step 5 Click **Finish** to finish creating face data.

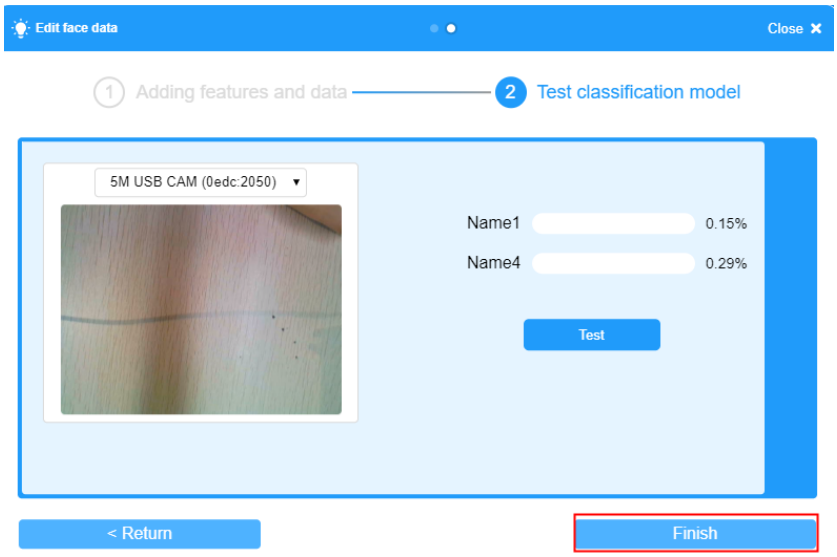


Figure 4.18 finish training model

Instruction Description

Table 4.48 sexual recognition

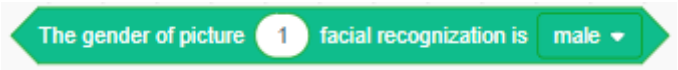
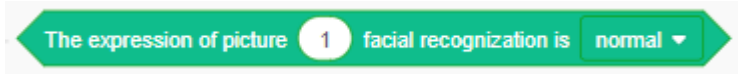
Instruction	
Description	Recognize sexual via face data
Parameter	Face data：put face data into the module Sexual：male, female
return	True：Recognize successfully False：Recognize failed
Example	Click key space to execute and recognize a man' sexual and expression. 

Table 4.49 Expression recognition

Instruction	
Description	Recognize expression via face data

Parameter	Expression： • Normal • Smile • Laugh
return	True：Recognize successfully False：Recognize failed
Example	Please refer to Table 4.48

Table 4.50 Get name

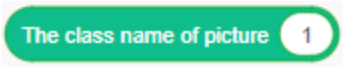
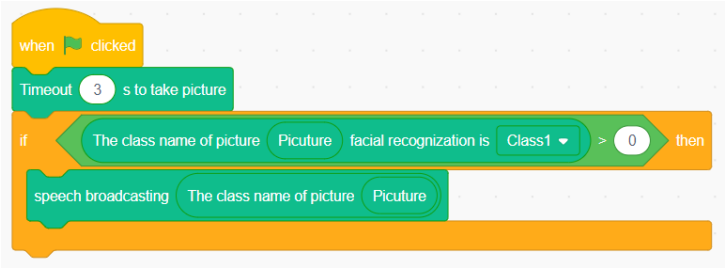
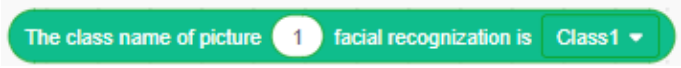
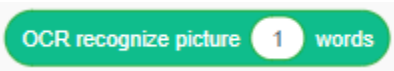
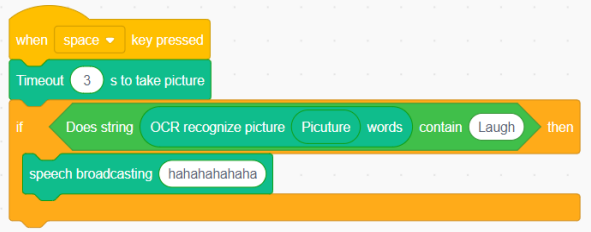
Instruction	
Description	Get name via face data
Parameter	Put face date into the module
return	Name
Example	Click  to execute program. If the picture match is greater than 0, broadcast picture's name 

Table 4.51 Face match

Instruction	
Description	Get face match results
Parameter	face：put a face data into the module name：select match name
return	Match range：0%~100%
Example	Please refer to Table 4.50

OCR Recognition

Table 4.52 OCR recognition

Instruction	
Derscription	Recognize the text of image
Parameter	Put an image into this module
Return	Text
Example	Press **space** key to execute program, the camera will take a picture after 3s, if the picture contains text **Laugh**, program will broadcast **hahahahahaha** 

4.2.3 Photoelectric and Color Sensor

Table 4.53 Set infrared sensor state

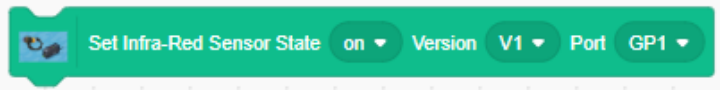
Instruction	
Description	Set infrared sensor state
Parameter	Status: set status on, off Version: Select the appropriate sensor version Port: Select the port where the sensor is connected to the robot
Return	None

Table 4.54 Get infrared sensor value

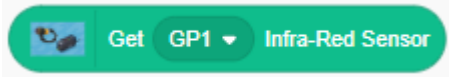
Instruction	
Description	Get Infrared Sensor value
Parameter	port：Select the port where the sensor is connected to the robot
Return	Value

Table 4.55 Get color sensor state

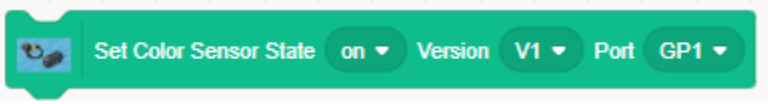
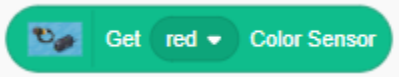
Instruction	
Description	Set color sensor status
Parameter	Status: set status • On • Off Version: Select the corresponding color sensor version Port: Select the port where the sensor is connected to the robot arm
Return	None

Table 4.56 Get color sensor value

Instruction	
Description	Get color sensor value
Parameter	Select color： • Red • Green • Blue
Return	Color value

4.3 Magic Box

Table 4.57 Output analog signal pin value

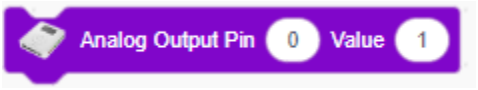
Instruction	
Description	Output analog signal pin value
Parameter	Pin：Set pin number Value：Set value, value range: 0~255
Return	None

Table 4.58 Output digital signal pin value

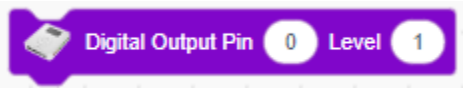
Instruction	
Description	Output digital signal pin value
Parameter	Pin：Set pin number Level：1：high level, 0：low level
Return	None

Table 4.59 Set pin state

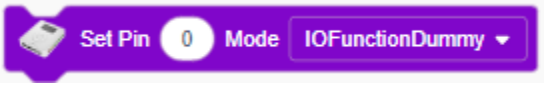
Instruction	
Description	Set pin state
Parameter	Pin: Select the pin according to the function type Function type: • IOFunctionDummy • IOFunctionDO • IOFunctionDI • IOFunctionPWM • IOFunctionADC • IOFunctionDIPU • IOFunctionDIPD
Return	None

Table 4.60 Set PWM output

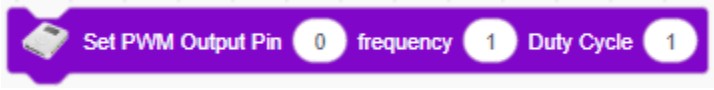
Instruction	
Description	Set PWM output
Parameter	Pin: input pin Frequency: Set the frequency. Value range: 10HZ ~ 1MHZ Duty Cycle: Set the duty cycle. Value range: 0 ~ 100
Return	None

Table 4.61 Read the value of a digital signal

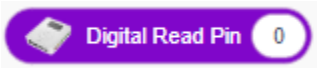
Instruction	
Description	Read the value of a digital signal
Parameter	Pin: Enter the pin number
Return	1：high level, 0：low level

Table 4.62 Read the value of a digital signal

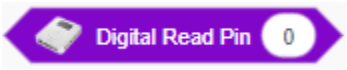
Instruction	
Description	Read the value of a digital signal
Parameter	Pin: Enter the pin number
Return	True: read successfully false: read failed

Table 4.63 Read the value of an analog signal

Instruction	
Description	Read the value of an analog signal
Parameter	Pin: Enter the pin number
Return	1：high level 0：low level

Table 4.64 Set stepper motor speed

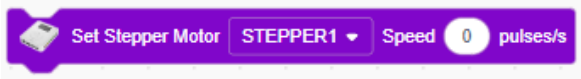
Instruction	
Description	Set stepper motor speed
Parameter	Motor: Select motor Speed: Motor speed (puls / s)
Return	None

Table 4.65 Set the number of stepping motor speed pulses

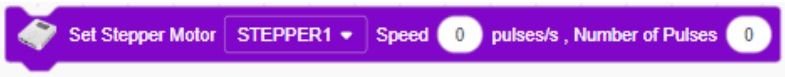
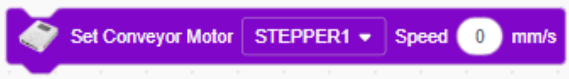
Instruction	
Description	Set the number of stepping motor speed pulses
Parameter	Motor: Select motor Speed: Set motor speed (puls/s) Pulse number: set the number of motor pulses
Return	None

Table 4.66 Set the conveyor motor speed

Instruction	
Description	Set the conveyor motor speed
Parameter	Motor: Select motor Speed: Set the motor speed
Return	None

4.4 Mobile Platform

4.4.1 Mobile Platform

Table 4.67 Initialize the mobile platform

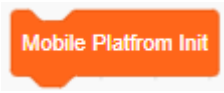
Instruction	
Description	Initialize the mobile platform
Parameter	None
Return	None

Table 4.68 Initialize the mobile platform key

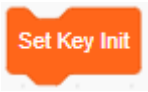
Instruction	
Description	Initialize the mobile platform key
Parameter	None
Return	None

Table 4.69 Set LED state

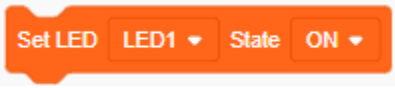
Instruction	
Description	Set LED state
Parameter	Sselect LED： • LED1 • LED2 • LED3 • LED4 Set state： • ON • OFF • BLINK
Return	None

Table 4.70 Set the movement direction and speed of the car

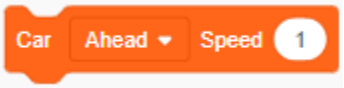
Instruction	
Description	Set the movement direction and speed of the car
Parameter	Direction： • Ahead • Back • Turn Left • Turn Right Speed: set the duty cycle, range (0 ~ 255)
Return	None

Table 4.71 Set the movement direction, speed and time of the car

Instruction	

Description	Set the movement direction, speed and time of the car
Parameter	Direction： • Ahead • Back • Turn Left • Turn Right Speed: set the duty cycle, range (0 ~ 255) Time: Set time (seconds)
Return	无

Table 4.72 Set the motor speed

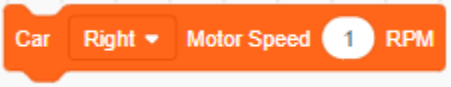
Instruction	
Description	Set the motor speed
Parameter	Select motor： • Right • Left speed：Set the motor speed, the setting range (0 ~ 160rpm)
Return	None

Table 4.73 Set the motor parameters

Instruction	
Description	Set the motor parameters
Parameter	KP: scale factor. Value range: 0.5 ~ 2.5 KI: integration factor. Value range: 0.05 ~ 0.5
Return	None

4.4.2 Sensor

Table 4.74 Start sonar

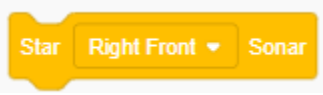
Instruction	
Description	Start sonar
Parameter	Select sonar： • Right Front • Front • Left Front
Return	None

Table 4.75 Detect barrier

Instruction	
Description	Detect barrier
Parameter	Select sonar： • Right Front • Front • Left Front
Return	true: Obstacle detected false: No obstacle detected

Table 4.76 Get detection distance

Instruction	
Description	Obtain ultrasound data of a certain position, that is, the distance between the car and the obstacle
Parameter	Select sonar： • Right Front • Front • Left Front
Return	Distance

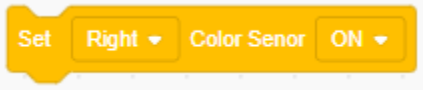
Table 4.77 Get the infrared sensor data

Instruction	
Description	Get the infrared sensor data
Parameter	Select IR： • IR1 • IR2 • IR3 • IR4 • IR5 • IR6
Return	IR data

Table 4.78 Set the color sensor white balance

Instruction	
Description	Set the color sensor white balance
Parameter	Select color sensor： • Right • Left
Return	None

Table 4.79 Set color sensor state

Instruction	
Description	Set color sensor state
Parameter	Select color sensor： • Right • Left state： • ON • OFF

Return	None

Table 4.80 Get RGB value

Instruction	
Description	This block is used to obtain the color value by the color sensor
Parameter	Select color sensor： • Right • Left Color： • Red • Green • Blue
Return	Infrared sensor color value. Value range: 0 ~ 255

Table 4.81 Detect color

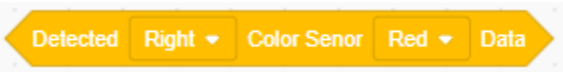
Instruction	
Description	This block is used to detect whether the color sensor detects a color
Parameter	Select color sensor： • Right • Left Color： • Red • Green • Blue
Return	True: Color detected False: No color detected

Table 4.82 Get the switch state

Instruction	

Description	Get the switch state
Parameter	Select button： • 1 • 2
Return	1：press 0：release

Table 4.83 Get the motor angle

Instruction	
Description	Get the motor angle
Parameter	Select motor： • Right • Left
Return	Angle

Table 4.84 Set the ultrasonic sensor detection threshold

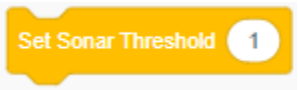
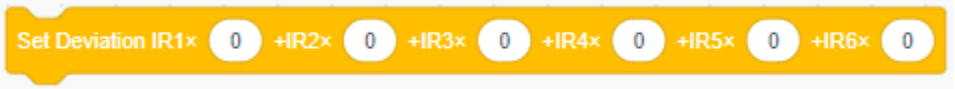
Instruction	
Description	Set the ultrasonic sensor detection threshold
Parameter	Set threshold: set the detection threshold, value range: 0 ~ 51.2cm
Return	None

Table 4.85 Set position offset

Instruction	
Description	Set the position offset corresponding to the sensor
Parameter	IR： • IR1 • IR2

	• IR3 • IR4 • IR5 • IR6 Set offset: Set the offset of each infrared pair. When setting the offset, you need to set the 6 infrared pair offsets to symmetric data centered on 0, for example: -3, -2, -1, 1, 2, 3 This will not cause the car to deviate from the black line during the line inspection process.
Return	None

Table 4.86 Get the infrared sensor offset

Instruction	
Description	Get the infrared sensor offset
Parameter	None
Return	Return deviation

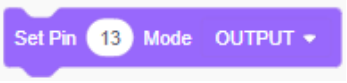
Table 4.87 Get the infrared sensor offset after PID processing

Instruction	
Description	Get the infrared sensor offset after PID processing
Parameter	None
Return	Return deviation

4.5 Arduino

4.5.1 Serial Port

Table 4.88 Set pin mode

Instruction	
Description	Set pin mode
Parameter	Pin: input pin index Select mode: • OUTPUT • INPUT

	• INPUI_PULLUP
Return	None

Table 4.89 Set baud rate for serial data transmission

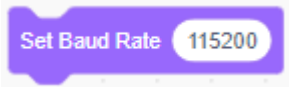
Instruction	
Description	Set baud rate for serial data transmission
Parameter	Baud rate: Set the baud rate for data transmission
Return	None

Table 4.90 Set Xbee data transmission baud rate

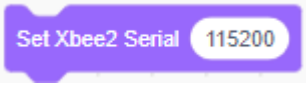
Instruction	
Description	Set Xbee data transmission baud rate
Parameter	Baud rate: Set the baud rate for data transmission
Return	None

Table 4.91 Serial print

Instruction	
Description	Serial print
Parameter	Set data
Return	None

Table 4.92 Serial line feed

Instruction	
Description	Serial line feed
Parameter	Set data

Return	None

Table 4.93 Get serial value length

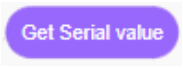
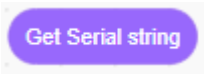
	
Description	Get serial value
Parameter	None
Return	Serial data byte

Table 4.94 Get serial string

Instruction	
Description	Get serial string
Parameter	None
Return	String

4.5.2 IO Operation

Table 4.95 Set Arduino digital level

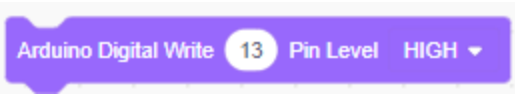
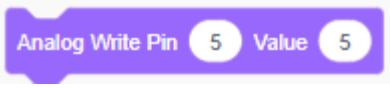
Instruction	
Description	Set Arduino digital level
Parameter	• pin • level：high or low
Return	None

Table 4.96 Set analog pin value

Instruction	
Description	Write analog value to the specified analog pin, used to control the brightness of the LED indicator or control the speed of the motor

Parameter	• pin：pin number • value：value range 0~255
Return	None

Table 4.97 Read digital signal pin

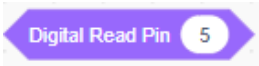
Instruction	
Description	Read digital signal pin value
Parameter	Pin: Pin number
Return	True: read successfully False: read failed

Table 4.98 Read digital signal pin value

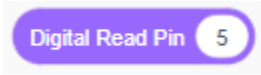
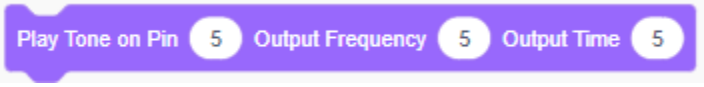
Instruction	
Description	Read digital signal pin value
Parameter	Pin: Pin number
Return	Pin value

Table 4.99 Read analog signal pins

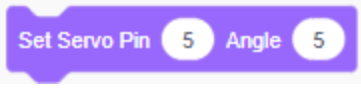
Instruction	
Description	Read analog signal pins
Parameter	Pin: Pin number
Return	Pin value

Table 4.100 Set the output frequency and output duration of the ultrasonic pin

Instruction	
Description	Set the output frequency and output duration of the ultrasonic pin
Parameter	• Pin number • Output frequency, value range: 31~65535HZ

	• Output duration, value range: 0~4294967295 us
Return	None

Table 4.101 Set angle of the servo motor

Instruction	
Description	Set angle of the servo motor
Parameter	• Pin: Pin number • Angle: Motor angle, value range: 0° ~180°
Return	None

4.5.3 Vision Recognition

You need to initialize it before using the vision kit. If you have previously saved the initialization data, you can click   to import to initialize it. Otherwise, click   to complete the initialization according to the wizard. The initialization steps are as follows

1. Follow the prompts to complete the initialization preparations.

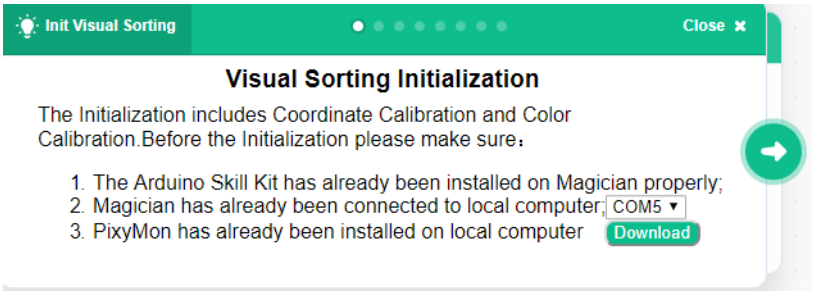


Figure 4.19 Vision sorting initialization

⚠NOTICE

Need to download and install PixyMo n according to different PC systems

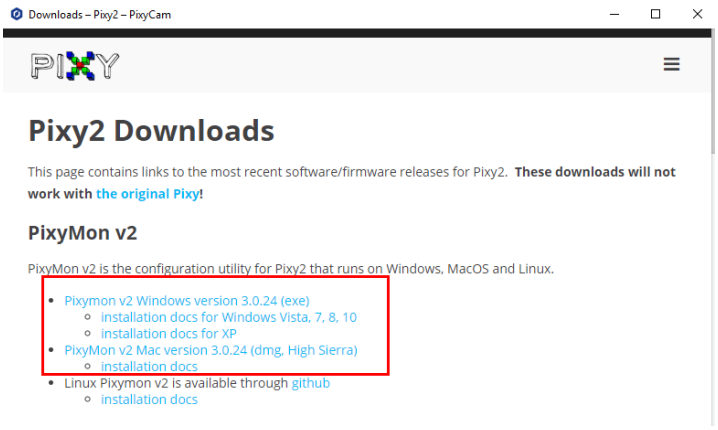


Figure 4.20 Download PixyMon

2. Move the robot arm to the suction cup close to the plane and click the "Record" button to record the plane height.

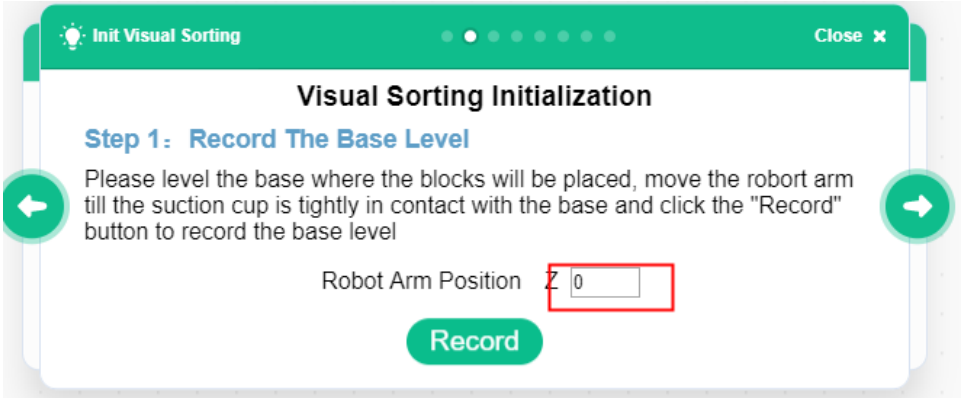


Figure 4.21 Record base level

3. According to the actual situation, write in the height of the different colored squares, and then click "Record".

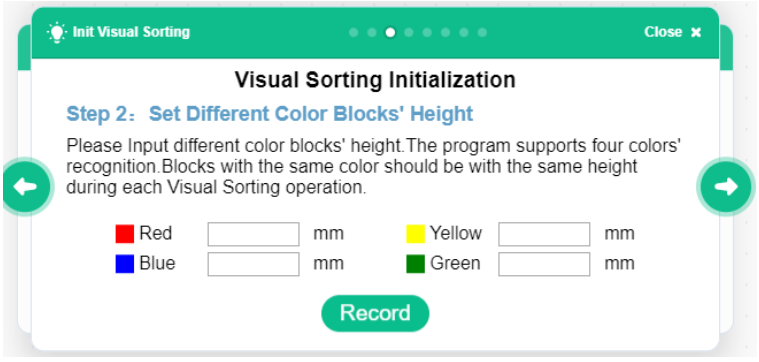


Figure 4.22 Record block height

4. Move the camera to the wooden block recognition position, click "Record" to obtain

the position of the robot arm or manually enter the position of the robot arm and click "Record".

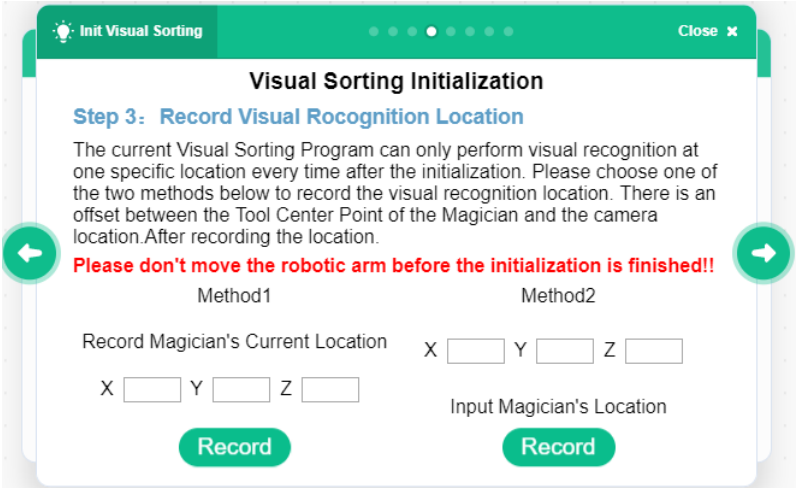


Figure 4.23 Record recognition position

5. Record the PixyMon calibration point reading. Follow the prompts to place the three calibration blocks into the camera's field of view. Click "Action" in the PixyMon window and repeatedly use the Signature1 box to select three wooden blocks, and write in the coordinates and height and width of the wooden blocks according to the box selection results, and click "Record".

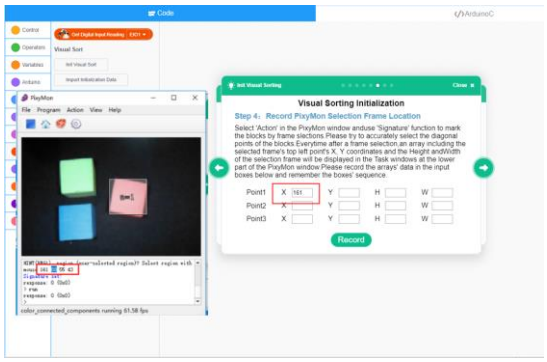


Figure 4.24 Record calibration position

⚠NOTICE

Before using Signature1 to select wooden blocks, you need to open the Console. Click on "View-> Console"

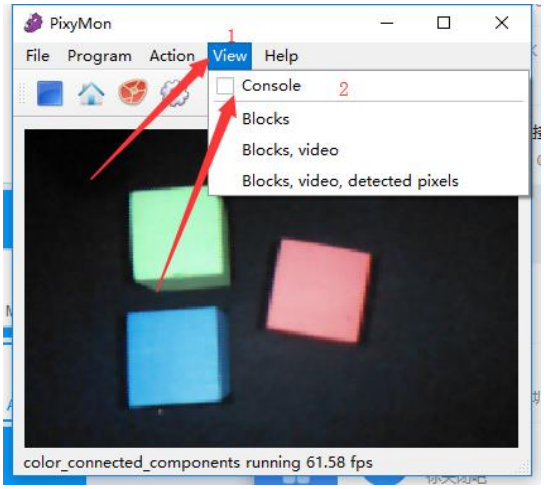


Figure 4.25 open console

6. Record the robot coordinates of the calibration block. Hold the robot arm close to the center of the three wooden blocks and click "Record" to record separately.

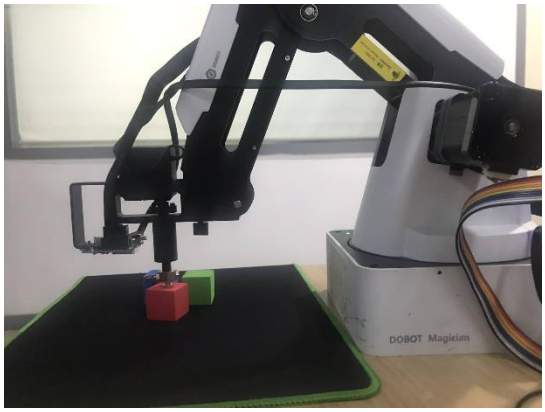


Figure 4.26 Hold the robot arm close to the center of the three wooden blocks

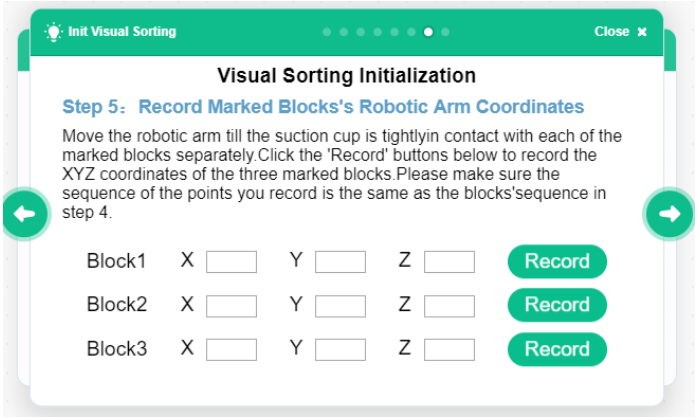


Figure 4.27 Record position

7. Color calibration. Put the wooden block that needs to identify the color in the field of vision, click "Action" according to the prompt and use Signature1, 2, 3, 4 to select the wooden block of the corresponding color, and match the color with the mark in the option box.

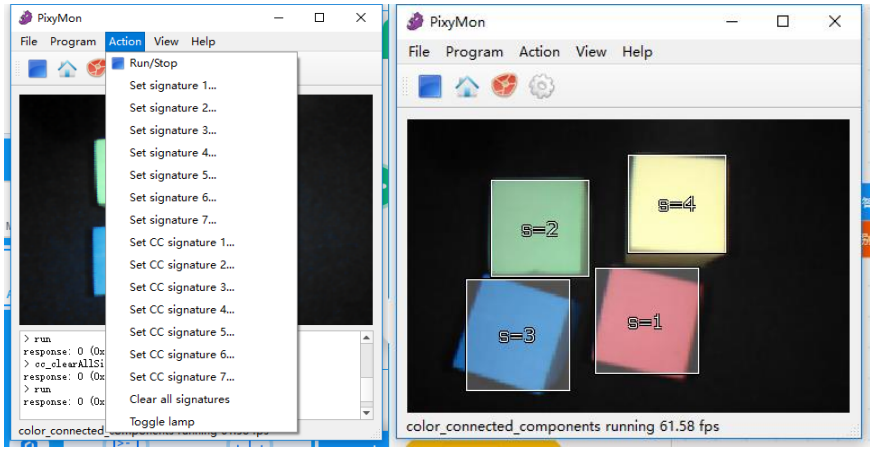


Figure 4.28 Select block

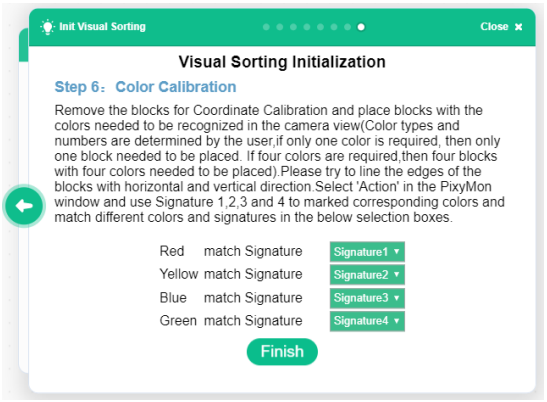


Figure 4.29 Color matching

4.5.4 Speech Recognition

Table 4.102 Initialize speech recognition module

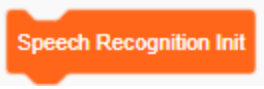
Instruction	
Description	Initialize speech recognition module
Parameter	None
Return	None

Table 4.103 Add speech

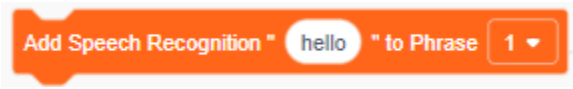
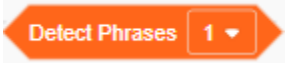
Instruction	
Description	Add speech to speech recognition module
Parameter	Voice content: Edit voice content Speech recognition phrase: Select the speech recognition phrase serial number to be added
Return	None

Table 4.104 Detect voice module

Instruction	
Description	Detect voice module
Parameter	Select speech recognition column number
Return	True: Voice detected False: No speech detected

4.5.5 JoyStick

Table 4.105 Get button status

Instruction	
Description	Get button status
Parameter	Select button： • Red • Green • Blue
Return	State: • true: Up • false: Down

Table 4.106 Set LED state

Instruction	
Description	Set LED state
Parameter	Select LED： • Red • Green • Blue State： • ON • OFF
Return	None

Table 4.107 Get LED state

Instruction	
Description	Get LED state
Parameter	Select LED • Red • Green • Blue
Return	LED state • True: ON • False: OFF

Table 4.108 Read Joystick value

Instruction	
Description	Read Joystick value
Parameter	Joystick coordinate • x • y
Return	Joystick value

Table 4.109 Check Joystick state

Instruction	
Description	Check Joystick state
Parameter	None
Return	Press state: • true: Up • false: Down

4.6 AIStarter

4.6.1 AIStarter

Table 4.110 Initialize AI-Starter

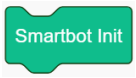
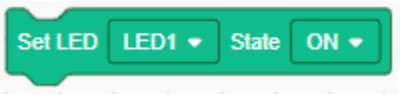
Instruction	
Description	Initialize AI-Starter
Parameter	None
Return	None

Table 4.111 Initialize switch

Instruction	
Description	Initialize switch
Parameter	None
Return	None

Table 4.112 Set LED status

Instruction	
Description	Set LED state
Parameter	Select LED: • LED1

	• LED2 Set state： • ON • OFF • BLINK
Return	无

Table 4.113 Set PID

Instruction	
Description	This program block is used to set the motor parameters
Parameter	KP: scale factor. Value range: 0.5 ~ 2.5 KI: integration factor. Value range: 0.05 ~ 0.5
Return	None

4.6.2 Motion

Table 4.114 Set direction and speed of AI-Starter

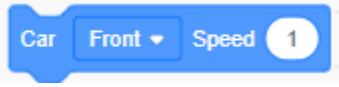
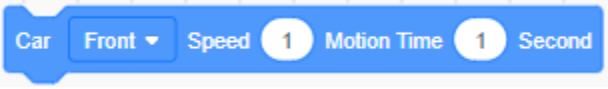
Instruction	
Description	Set direction and speed of AI-Starter
Parameter	Direction: • Ahead • Back • Turn left • Turn right Speed: Set Duty ratio. Value range: 0-255
Return	None

Table 4.115 Set the movement direction, speed and time of AI-Starter

Instruction	

Description	Set the movement direction, speed and time of AI-Starter
Parameter	Direction: • Ahead • Back • Turn left • Turn right Speed: Set Duty ratio. Value range: 0-255
Return	None

Table 4.116 Set motor speed

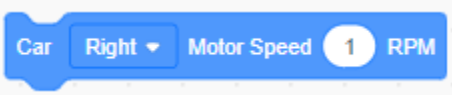
Instruction	
Description	Set motor speed
Parameter	Select the motor • LEFT • RIGHT Speed: Set the motor speed. Value range: 0r/m – 100r/m
Return	None

Table 4.117 Attach sever

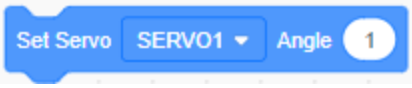
Instruction	
Description	Make servo attach to make AIStarter unload
Parameter	Select servo
Return	None

Table 4.118 Detach servo

Instruction	
Description	Make servo detach to make AIStarter restore

Parameter	Select servo
Return	None

Table 4.119 Set servo angle

Instruction	
Description	Set servo angle
Parameter	Servo：select motor Angle：set angle
Return	None

4.6.3 Sensor

Table 4.120 Start sonar

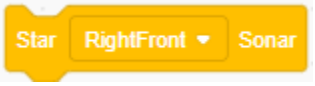
Instruction	
Description	Start sonar
Parameter	Sonar position： • Right Front • Front • Left Front
Return	None

Table 4.121 Detect barrier

Instruction	
Description	Detect whether a barrier is exist in front of AI-Starter, before calling this module, please start the corresponding sonar
Parameter	Obstacle position: • Right Front • Front Left Front
Return	true: There is a barrier false: There is no barrier

Table 4.122 Get sonar data

Instruction	
Description	Get the detection distance of sonar, which is the distance between AI-Starter and barrier.
Parameter	Sonar position: • Right Front • Front Left Front
Return	Detection distance

Table 4.123 Get infrared sensor data

Instruction	
Description	Get infrared sensor data
Parameter	IR： • IR1 • IR2 • IR3 • IR4 • IR5 • IR6
Return	false: Black line true: White line

Table 4.124 Get geomagnetic angle

Instruction	
Description	Get geomagnetic angle
Parameter	None
Return	Geomagnetic angle

Table 4.125 Set calibration

Instruction	
Description	Calibration method: Press down the left-most key after starting up, make AI-Starter rotate 360° around space axes X, Y, Z respectively, press down the left-most key once again to finish calibration
Parameter	None
Return	None

Table 4.126 Set color sensor white balance

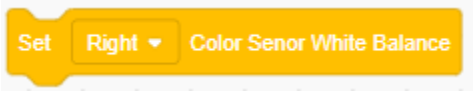
Instruction	
Description	Set color sensor white balance
Parameter	Color sensor： • Right • Left
Return	None

Table 4.127 Set color sensor state

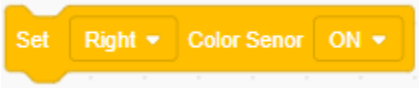
Instruction	
Description	Set color sensor state
Parameter	Color sensor： • Right • Left state： • ON • OFF
Return	None

Table 4.128 Detect RGB

Instruction	
Description	Get color sensor value
Parameter	Color sensor： • Right • Left Color: • Red • Green • Blue
Return	True: Detect successfully False: Detect failed

Table 4.129 Get RGB

Instruction	
Description	Get color sensor value
Parameter	Color sensor: • Right • Left Color： • Red • Green • Blue
Return	Color sensor value. Value range: 0~255

Table 4.130 Get Switch state

Instruction	
Description	Get switch state
Parameter	Switch： • Switch 1 • Switch 2 • Switch 3

Return	true: Press false: Release

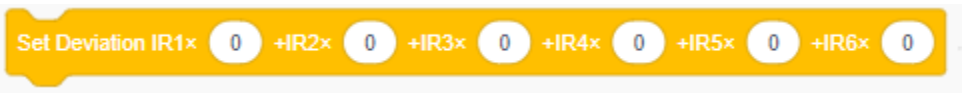
Table 4.131 get photosensitive value

Instruction	
Description	get photosensitive value
Parameter	None
Return	Photosensitive value. Value range: 0 – 4096

Table 4.132 Set sonar threshold

Instruction	
Description	Set sonar threshold
Parameter	Set threshold. Value range: 0~51.2cm
Return	None

Table 4.133 Set the position offset

Instruction	
Description	Set the position offset corresponding to the sensor
Parameter	IR： • IR1 • IR2 • IR3： • IR4： • IR5： • IR6： Set offset: Set the offset of each infrared pair. When setting the offset, you need to set the 6 infrared pair offsets to symmetric data centered on 0, for example: -3, -2, -1, 1, 2, 3 This will not cause the car to deviate from the black line during the line inspection process.

Return	None

Table 4.134 Get the infrared sensor offset

Instruction	
Description	Get the infrared sensor offset
Parameter	None
Return	Return deviation

Table 4.135 Get the infrared sensor offset after PID processing

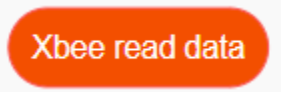
Instruction	
Description	Get the infrared sensor offset after PID processing
Parameter	None
Return	Return deviation

Table 4.136 Get motor pose

Instruction	
Description	Get motor pose
Parameter	Select motor： • Right • Left
Return	Motor pose (Number of pulses obtained by the encoder)

4.6.4 Xbee

Table 4.137 Get Xbee value

Instruction	
Description	该Instruction用于读取Xbee数值
Parameter	无

Return	Xbee数值

Table 4.138 Send Xbee value

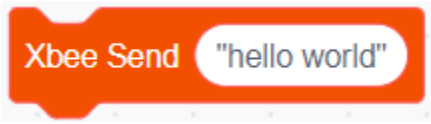
Instruction	
Description	Send Xbee values
Parameter	Value: Set the value to be sent
Return	None

Table 4.139 Compare two Xbee value

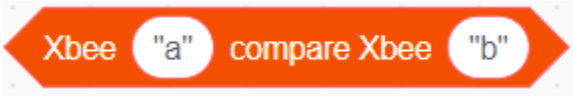
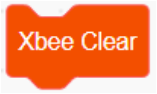
Instruction	
Description	Compare two Xbee values
Parameter	Value: Set the value to be compared
Return	Ture: same False: different

Table 4.140 Clear Xbee cache

Instruction	
Description	Clear the Xbee cache
Parameter	None
Return	None

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