DobotBlock User Guide

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Preface

Purpose

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

Intended Audience

This document is intended for:

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

Change History

Date	Change Description
2020/07/24	Modify the descriptions of some blocks
2020/07/10	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

DobotBlock 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 provides programming instruction for Dobot hardware devices. The devices that DobotBlock supported are Dobot Magician, Dobot Magician Lite, Magic Box, AI-Starter, Mobile Platform, and Arduino. The homepage is shown as Figure 1.1. For details, please see Table 1.1.

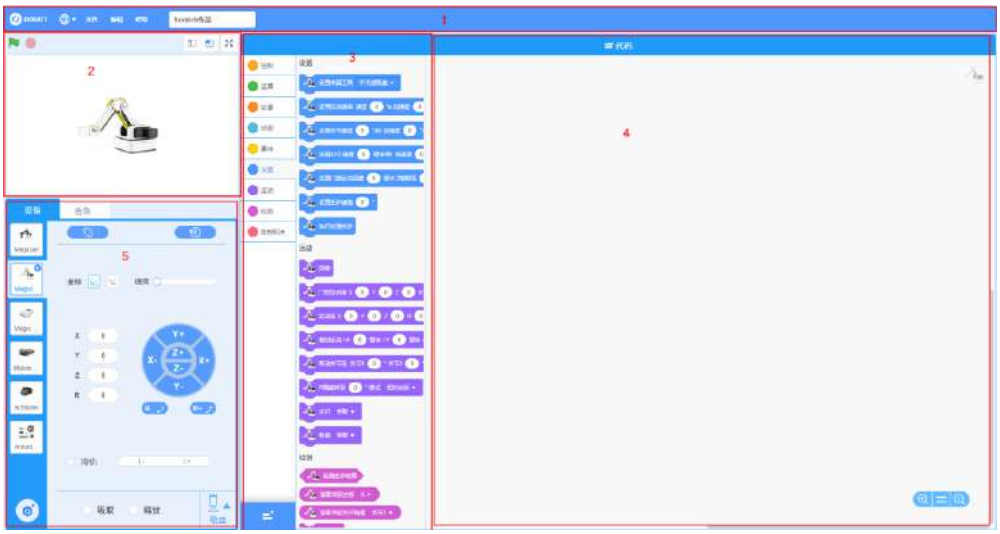


Figure 1.1 Homepage

Table 1.1 Homepage description

No.	Function	Description
1	Menu bar	Set 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-effector 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 Figure 2.1.

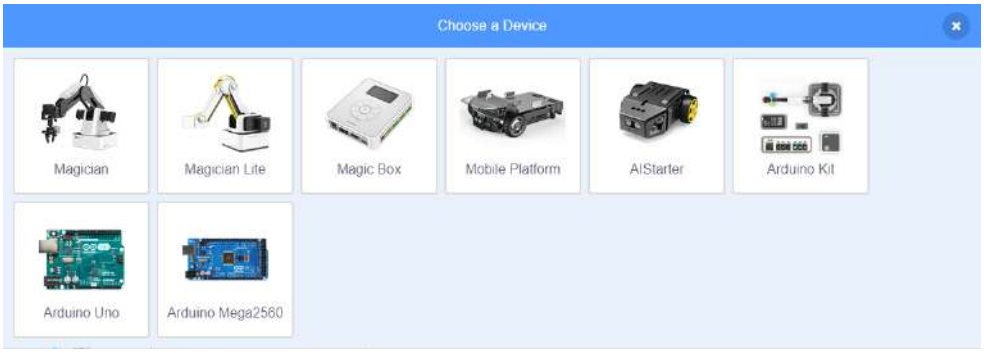


Figure 2.1 Device selection

The block area will show the corresponding instruction after selecting a device. You can also click  to add extension device in the extension center, as shown in Figure 2.2.

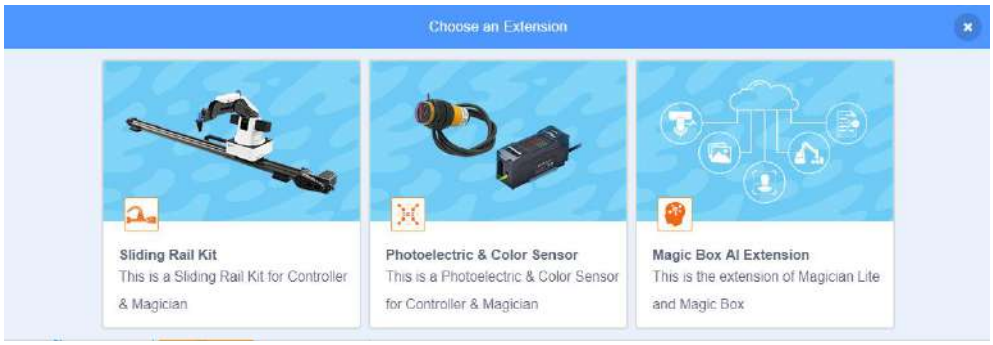


Figure 2.2 Extension center

📖NOTE

A DobotBlock software can control multiple devices at the same time.

3. Quick Start

3.1 Device Connection

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

Prerequisites

Magician Lite has been connected to PC via USB

Procedure

Step 1 Power on the Magician Lite.

Step 2 Launch a DobotBlock.

Step 3 Click  on the DobotBlock page and then select **Magician Lite** on the **Choose a Device** page.

Step 4 Click  to connect Magician Lite and DobotBlock.

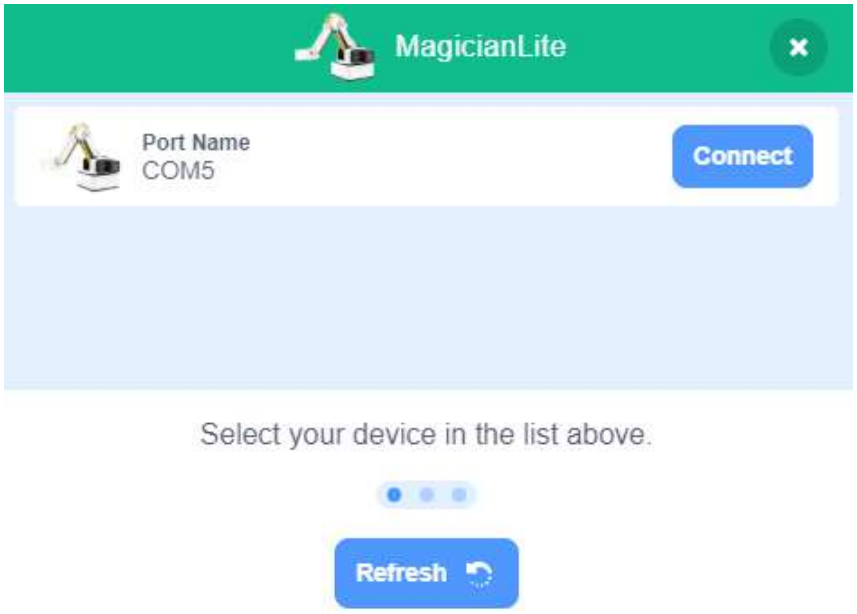


Figure 3.1 Connect Magician Lite and DobotBlock

Step 5 After connecting Dobot Magician Lite and DobotBlock, you can drag blocks in the block area to start programming, as shown in Figure 3.2, click  to move Magician Lite to the homing point.

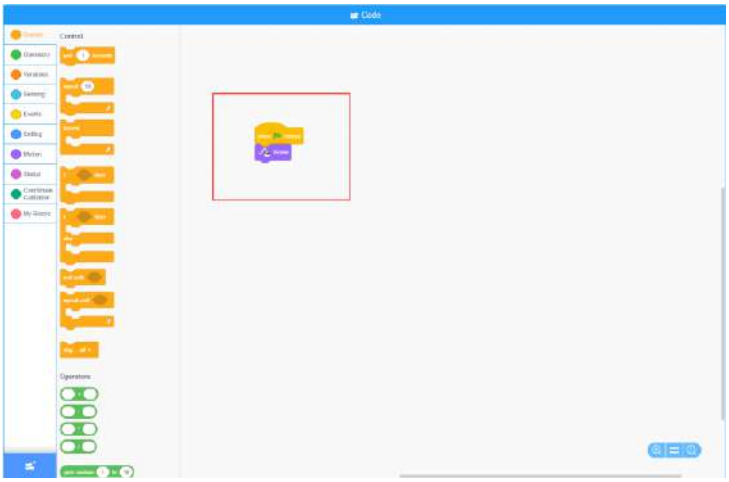


Figure 3.2 Start programming

3.2 Program Upload

DobotBlock supports multiple Dobot devices. This section takes Magic Box as an example to describe how to upload program to devices.

Prerequisites

- Magic Box has been connected to Magician Lite.
- Magic Box has been connected to PC via USB.
- Magic Box has been connected to DobotBlock.

Procedure

Step 1 Click  on the Magic Box page and then select **Magician Lite** on the **Choose an extension** page.

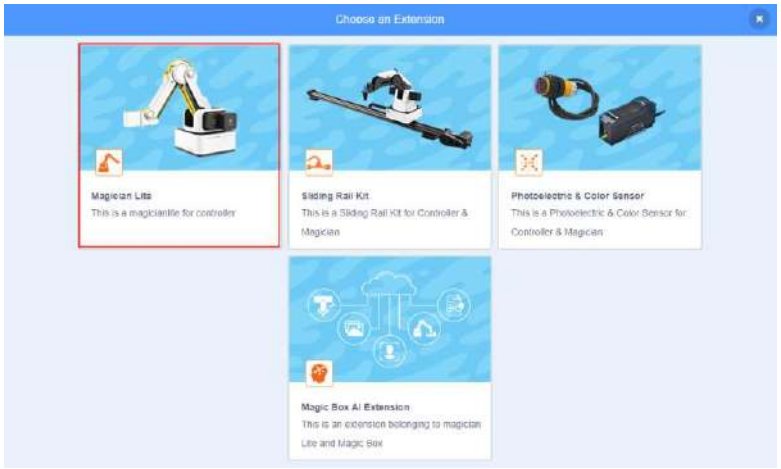


Figure 3.3 Choose an extension

Step 2 Drag the blocks to the block area, as shown in Figure 3.4.

Figure 3.4 Drag blocks to the block area

Step 3 Click  on the Magic Box page to switch the offline mode.

Figure 3.5 Switch offline mode

Step 4 Click  to select the corresponding serial port and click **Upload** to upload code, as shown in Figure 3.6.

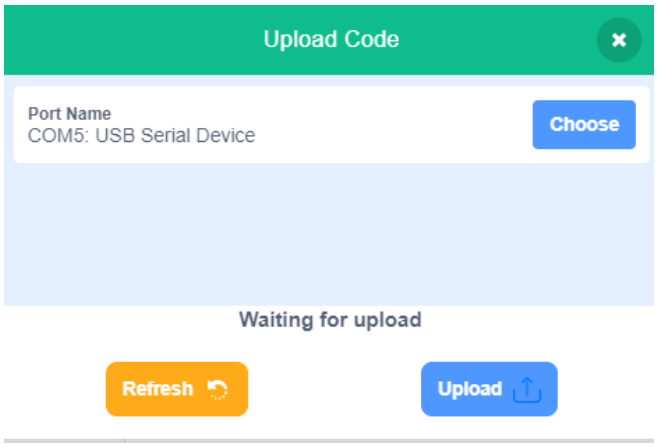
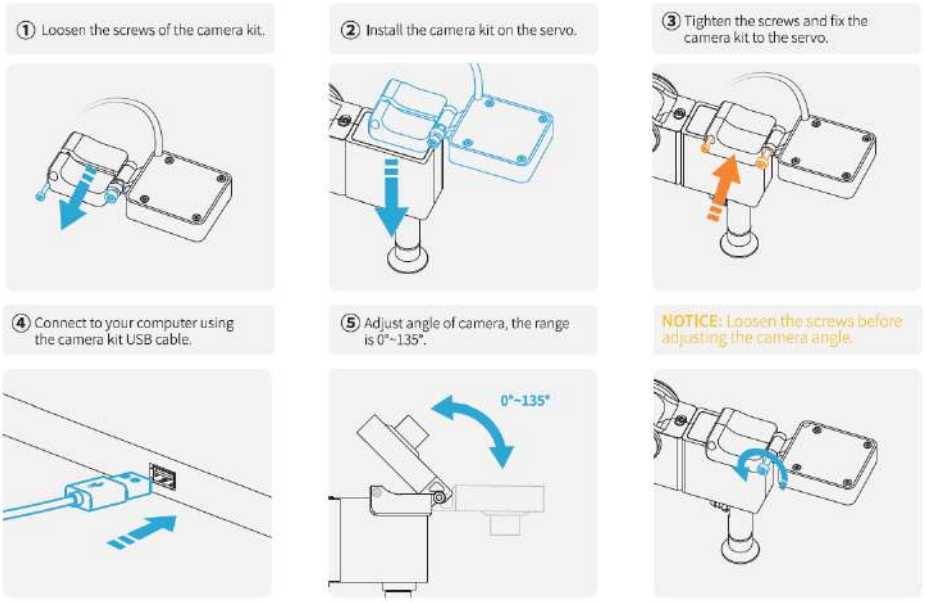


Figure 3.6 Select the corresponding serial port to upload code

4. AI Camera Description

4.1 AI Camera Installation



4.2 Image Recognition

4.2.1 Model Training

Step 1 Click **Edit classification data** to create image data.

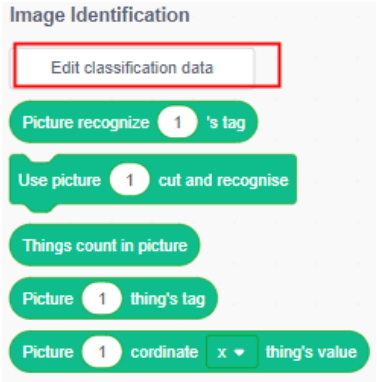


Figure 4.1 Edit classification data

Step 2 Click  to get image and name it. (please close your computer camera before using camera)

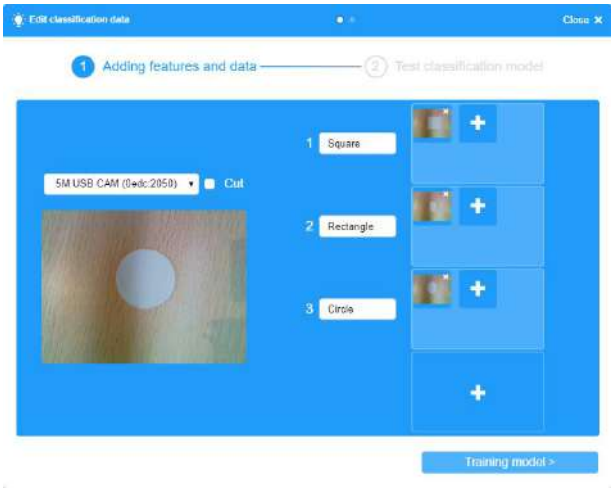


Figure 4.2 Get image

Step 3 Click **Training model** to test image, put different shapes below the camera to match feature.

Figure 4.3 Circle matching

Figure 4.4 Rectangle matching

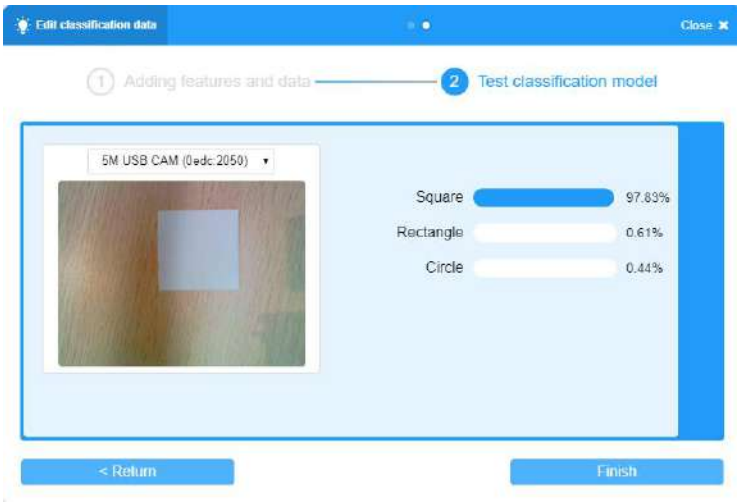


Figure 4.5 Square Matching

Step 4 When the model match is close to 100%, click **Finish** to complete the model training (if model match fails, you need to re-acquire the image and retrain it)

4.2.2 Program Creating

Classify different shapes based on model match. The program is written as follows.

NOTICE

- The target points (A, B, C) can be set based on site requirements.
- To make the suction cup absorb an object accurately, please drag the end-effector to the position in the hand-teach mode where the end-effector touches the object and then input the position values into the blocks

Click  to run the program. Place different shapes under the camera according to the voice prompts, and observe the operation of robot arm.

4.3 Face recognition

4.3.1 Model Training

Step 1 Click **New face data** to popup the create face data interface.

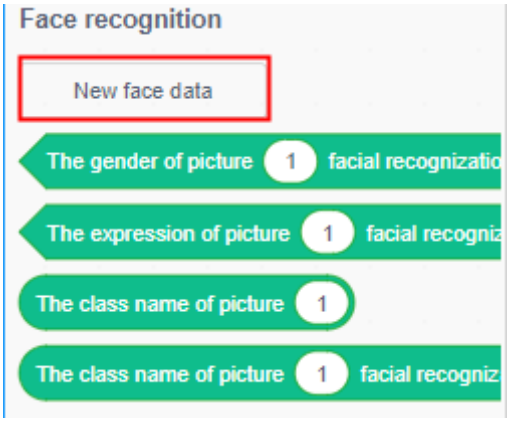


Figure 4.6 Create face data

Step 2 Click  get face data and name it.

Figure 4.7 Get face data and name it

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

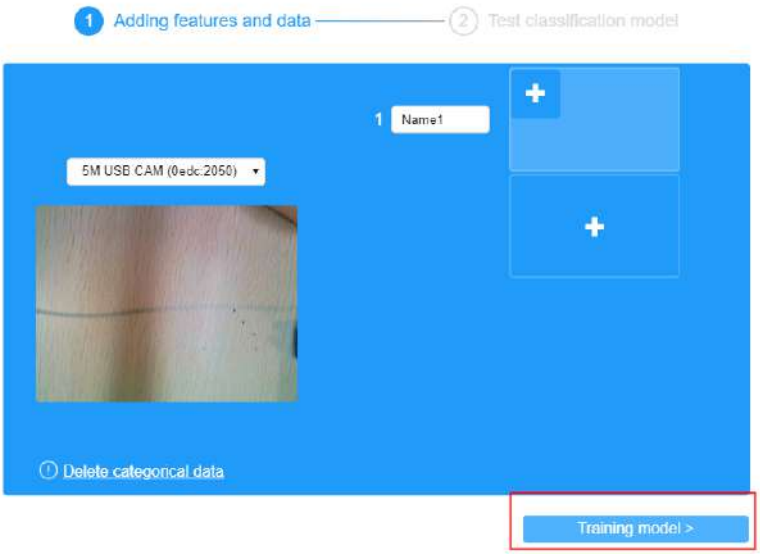


Figure 4.8 Training model

Step 4 Put your face under the camera, and click **Test** to match feature. If the matching rate is close to 100%, click **Finish** to complete the matching. If the rate of matching is low, you can re-acquire face image for secondary matching.

Figure 4.9 Train model

4.3.2 Program Creating

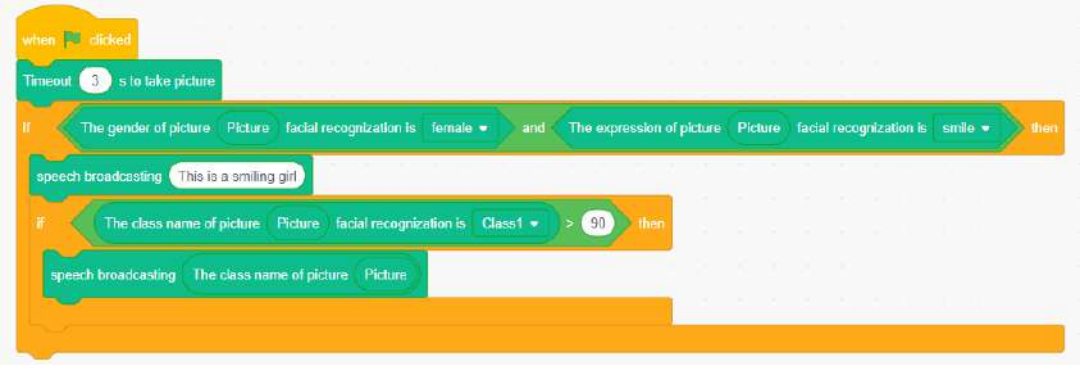


Figure 4.10 Program

Click  to run the program. Put a women face under the camera, and observe the operation of robot arm.

4.4 OCR Recognition

OCR text recognition does not require model training, and the text can be directly recognized under the camera.

Press space bar to execute the program and take a photo automatically after 3s. If the picture label contains the character "Detect", the voice will be played.

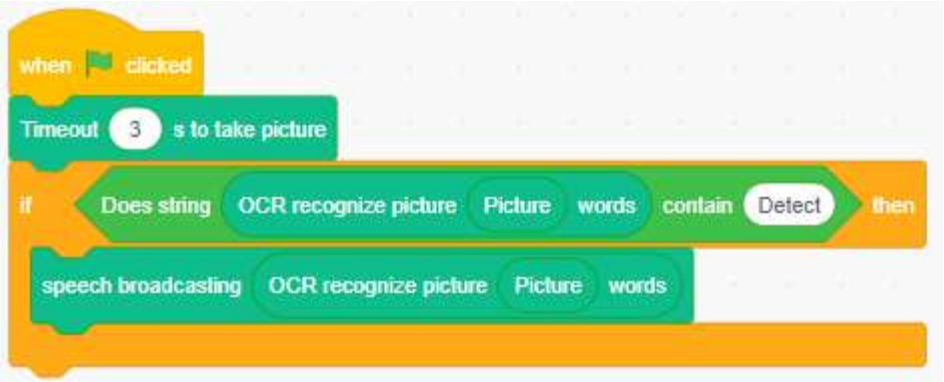


Figure 4.11 OCR recognition

5. Program Instructions

5.1 Magician/Magician Lite

5.1.1 Setting

Table 5.1 Select end-tool

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

Table 5.2 Set PTP motion ratio

Instruction	
Description	Set motion ratio
Parameter	Speed ratio: Set the speed ratio Acceleration ratio: Set the acceleration ratio
Return	None

Table 5.3 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 5.4 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 the Cartesian axis acceleration
Return	None

Table 5.5 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 (pulse/s)
Return	None

Table 5.6 Set the lifting height and maximum lifting height in Jump mode

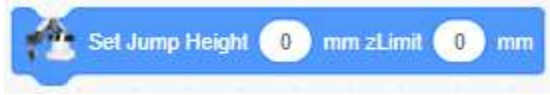
Instruction	
Description	Set the lifting height and maximum lifting height
Parameter	Height: Set the lifting height zLimit: Set the maximum lifting height
Return	None

Table 5.7 Set lost step threshold

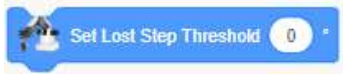
Instruction	
Description	Set lost-step detection threshold to detect whether the positioning error exceeds the threshold. If exceeded, the motor will lose steps
Parameter	Lost-step threshold value
Return	None

Table 5.8 Set the number of stepper motor speed pulses

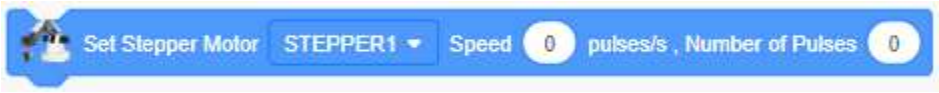
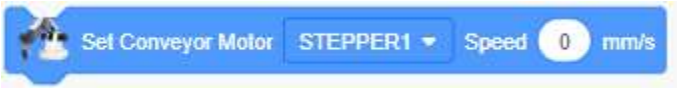
Instruction	
Description	Set stepper motor speed. (This block is only supported by Magician)
Parameter	Motor: Select motor Speed: Set the motor speed (pulse/s) Pulse number: set the motor pulses
Return	None

Table 5.9 Perform motor loss detection

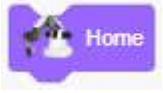
Instruction	
Description	Perform motor loss detection
Parameter	None
Return	None

Table 5.10 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. Value range: 0mm/s-120mm/s
Return	None

5.1.2 **Motion**

Table 5.11 Home operation

Instruction	

Description	Home operation
Parameter	None
Return	None

Table 5.12 Move robot to a target point in jump mode

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

Table 5.13 Move robot to a target position in a certain type of motion mode

Instruction	
Description	Move robot to a target position with a certain type of motion mode
Parameter	X: Set X-axis coordinate value Y: Set Y-axis coordinate value Z: Set Z-axis coordinate value R: Set R-axis coordinate value Move Type: • Joint • Straight Line
Return	None

Table 5.14 Move robot to a target position

Instruction	
Description	Move robot to a target position

Parameter	△X: Set X-axis increment value △Y: Set Y-axis increment value △Z: Set Z-axis increment value △R: Set R-axis increment value
Return	None

Table 5.15 Move robot to a target position

Instruction	
Description	Move robot to a target position
Parameter	Joint1: Set the angle of Joint 1 Joint2: Set the angle of Joint 2 Joint3: Set the angle of joint 3 Joint4: Set the angle of joint 4
Return	None

Table 5.16 Set R axis rotation angle

Instruction	
Description	Set R-axis rotation angle
Parameter	R: Set R-axis rotation angle
Return	None

Table 5.17 Set suction cup status

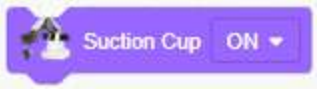
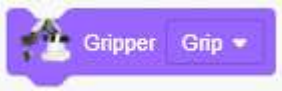
Instruction	
Description	Set suction cup status
Parameter	Suction cup status: • ON • OFF
Return	None

Table 5.18 Set gripper status

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

5.1.3 **Detection**

Table 5.19 Get robot Cartesian coordinates

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

Table 5.20 Get robot joint coordinates

Instruction	
Description	Get robot joint coordinates
Parameter	Joint： • Joint 1 • Joint 2 • Joint 3 • Joint 4
Return	Return joint angle

Table 5.21 Detect whether robot loses step

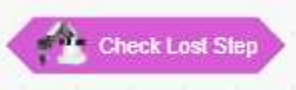
Instruction	
Description	Detect whether robot loses step
Parameter	None
Return	True: step lost False: no step lost

Table 5.22 Clear robot alarm

Instruction	
Description	Clear robot alarm
Parameter	None
Return	None

5.1.4 I/O（Only Magician Supported）

Table 5.23 Set EIO state

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

Table 5.24 Set PWM output

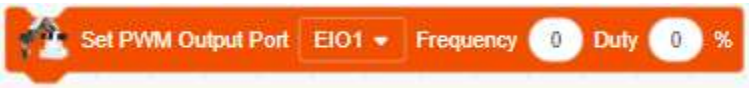
Instruction	
Description	Set PWM output
Parameter	EIO: Select IO address Frequency: Set the frequency. Value range: 10HZ - 1MHZ Duty Cycle: Set the duty cycle. Value range: 0 - 100
Return	None

Table 5.25 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 5.26 Get the value of a digital signal

Instruction	
Description	Get the value of a digital signal
Parameter	EIO: Select EIO
Return	0: Low level; 1: High level

Table 5.27 Get the value of an analog signal

Instruction	
Description	Get the value of an analog signal
Parameter	EIO：Select EIO
Return	0-4095

5.1.5 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**, follow the prompts to install the suction cup, and click **Next.**

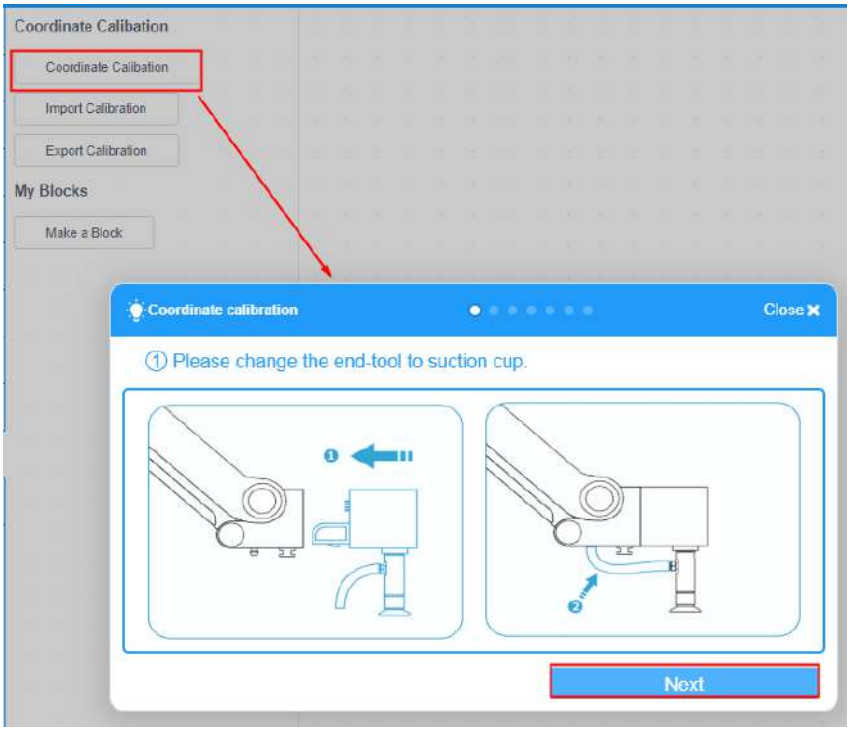


Figure 5.1 Install suction cup

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

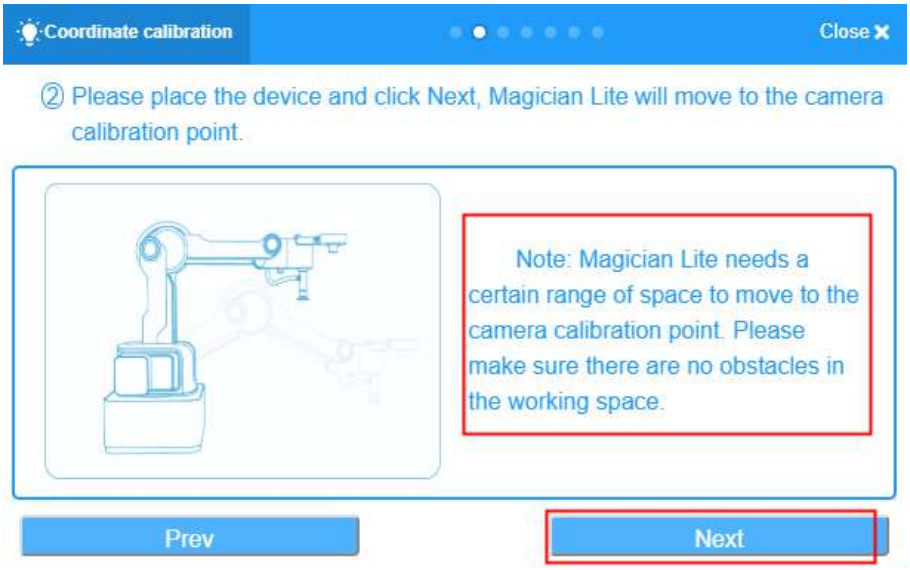


Figure 5.2 Place Magician Lite

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

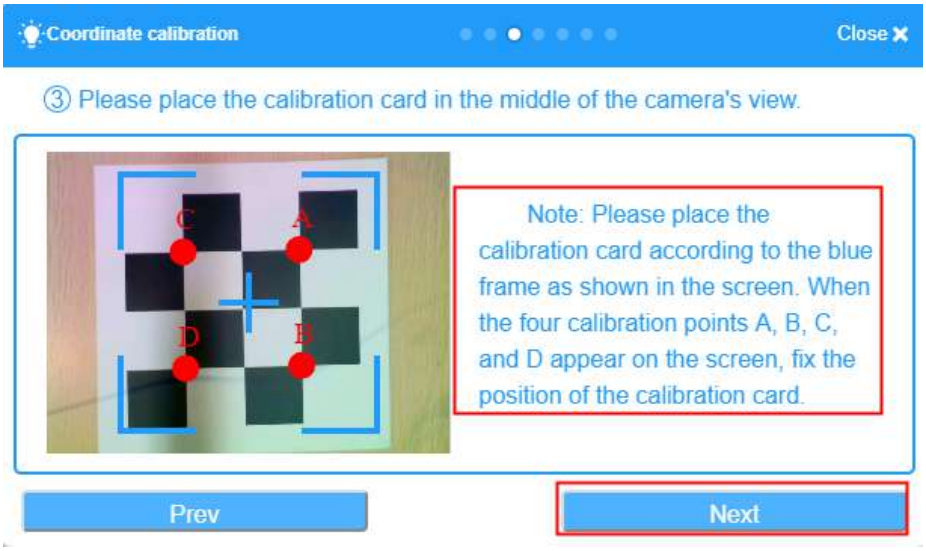


Figure 5.3 Place calibration card

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

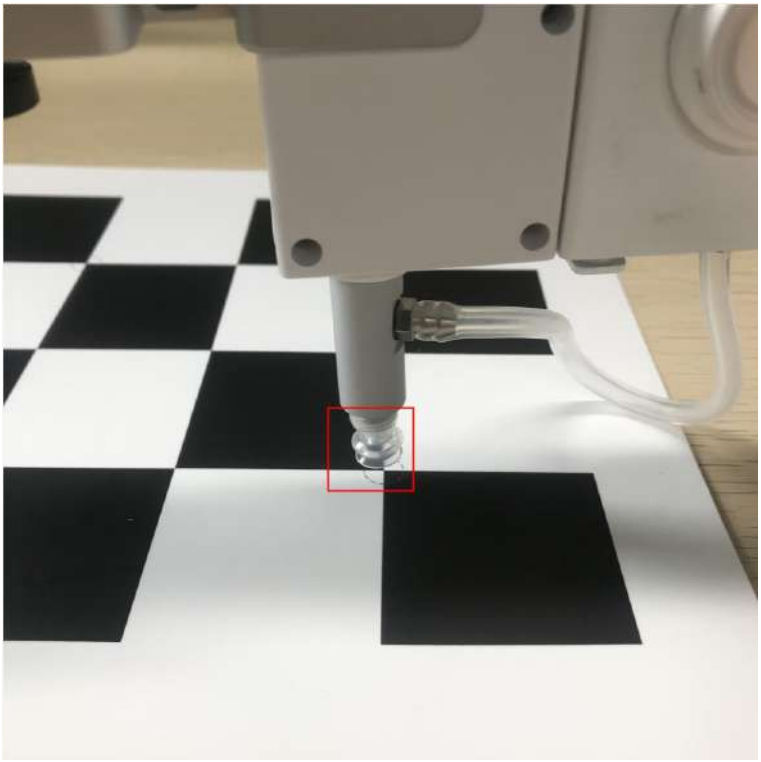


Figure 5.4 Move the end suction cup to the calibration point A

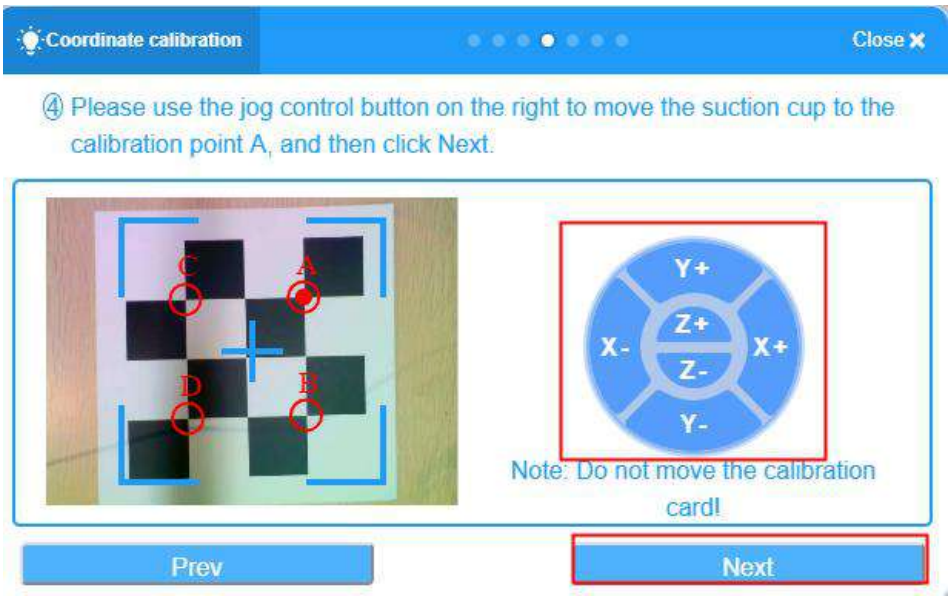


Figure 5.5 Calibration point A

📖NOTE

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

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

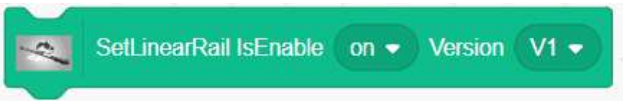
5.2 Extension Device

5.2.1 Sliding rail

⚠NOTE

When using Magician Lite+BOX with sliding rail, you need to add a homing command at the beginning of the program to make Magician Lite move to the homing position at first.

Table 5.28 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 5.29 Get sliding rail state

Instruction	
Description	Get Sliding rail state
Parameter	None
Return	None

Table 5.30 Move the sliding rail a certain distance

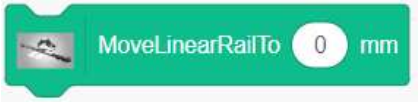
Instruction	
Description	Move the sliding rail a certain distance
Parameter	Distance: Set the moving distance
Return	None

Table 5.31 Set the speed and acceleration in PTP mode

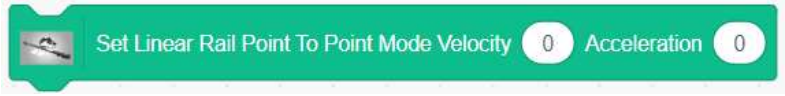
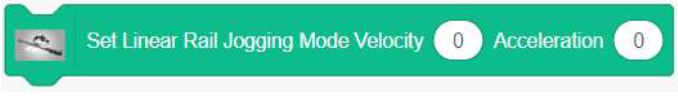
Instruction	
Description	Set the speed and acceleration in PTP mode
Parameter	Speed: Set the speed of the sliding rail Acceleration: Set the acceleration of the sliding rail
Return	None

Table 5.32 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 5.33 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 5.34 Get the speed and acceleration in jogging mode

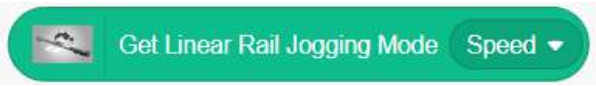
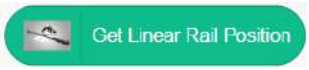
Instruction	
Description	Get the speed and acceleration in jogging mode
Parameter	Select the parameter speed (mm/s) or acceleration (mm/s²)
Return	Speed or acceleration

Table 5.35 Get sliding rail position

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

5.2.2 AI

5.2.2.1 Speech Recognition

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

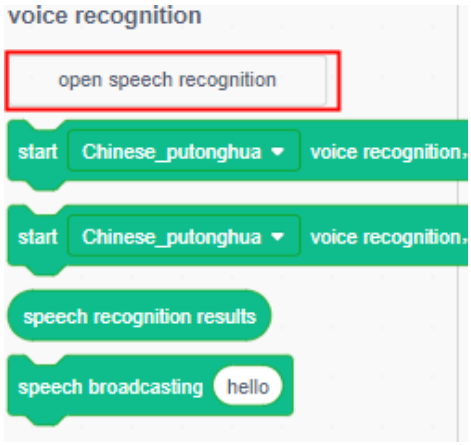


Figure 5.6 Open speech recognition

Step 2 Select a language and click **Start** to recognize your voice.

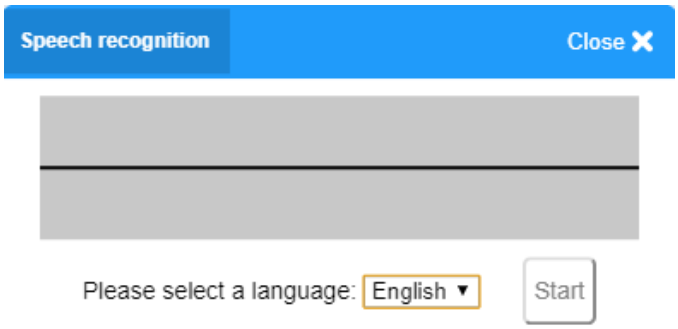


Figure 5.7 Start recognition

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

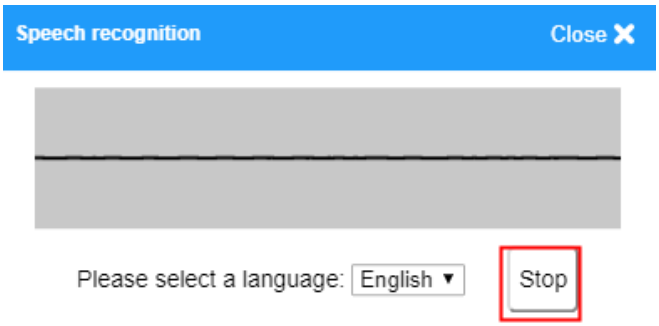
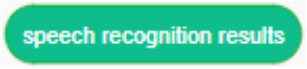


Figure 5.8 Stop recognition

Step 4 Close this interface, and the recognition result will be saved to **speech recognition**

results module 

.

Table 5.36 Recognize speech automatically

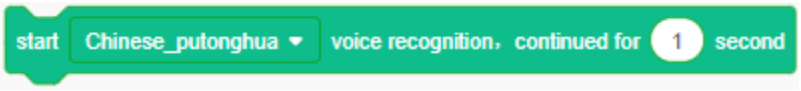
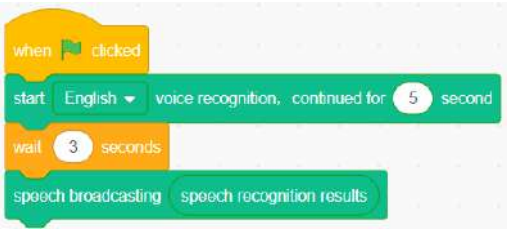
Instruction	
Description	Recognize speech automatically
Parameter	Select language: Select language to **Chinese_putonghua** or **English** Time：Set speech recognition time
return	None
Example	Click  to execute program. Say something for 5s, wait for 3s to broadcast speed result 

Table 5.37 Recognize speech manually

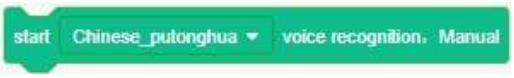
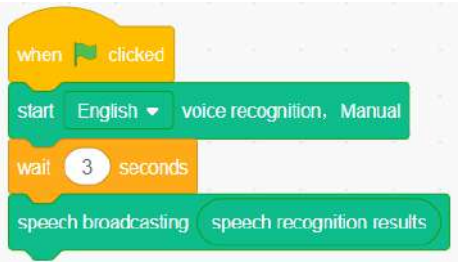
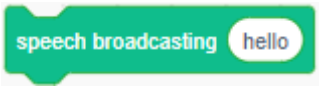
Instruction	
Description	Recognize speech manually
Parameter	Select language：select language to **Chinese_putonghua** or **English**
return	Nome
Example	Click  to execute program. Click **Start** to say something, when you finish speaking, click **Stop**, and then wait for 3s to broadcast speed result 

Table 5.38 Speech recognition result

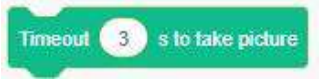
Instruction	
Description	Get speech recognition results
Parameter	None
return	Speech recognition results
Example	Please refer to Table 5.37

Table 5.39 broadcast speech

Instruction	
Description	Broadcast speech
Parameter	Set speech that you need to broadcast
return	None
Example	Please refer to Table 5.37

5.2.2.2 **Image Getting**

Table 5.40 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.

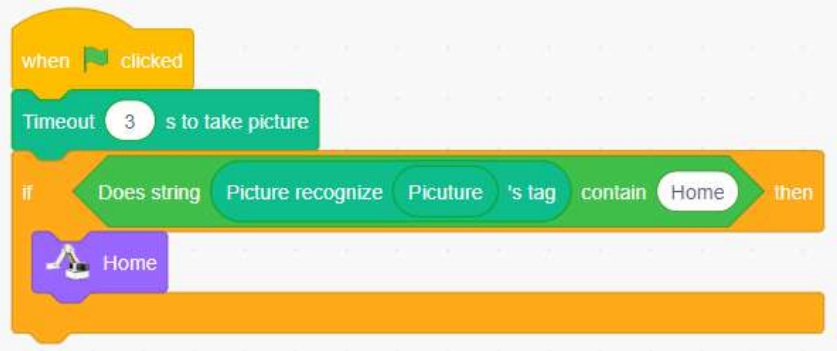
	

Table 5.41 Get image manually

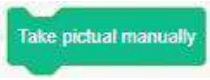
Instruction	
Description	Get image manually
Parameter	None
return	None
Example	Click  and click **take a picture**, if the picture's tag contains **Home**, the Robot will execute home function 

Table 5.42 Save image

Instruction	
Description	Get image information
Parameter	None
return	Image information
Example	Please refer to Table 5.41

5.2.2.3 Image Recognition

Step 1 Click **Edit classification data** to create image data.

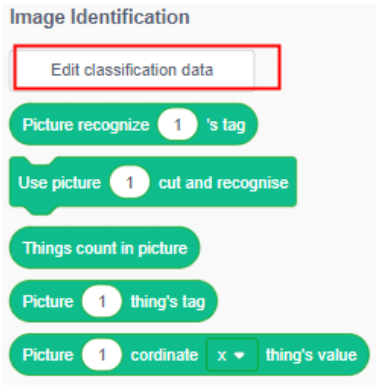


Figure 5.9 Edit classification data

Step 2 Click  to get image and name it. (please colse your computer camera before using camera)

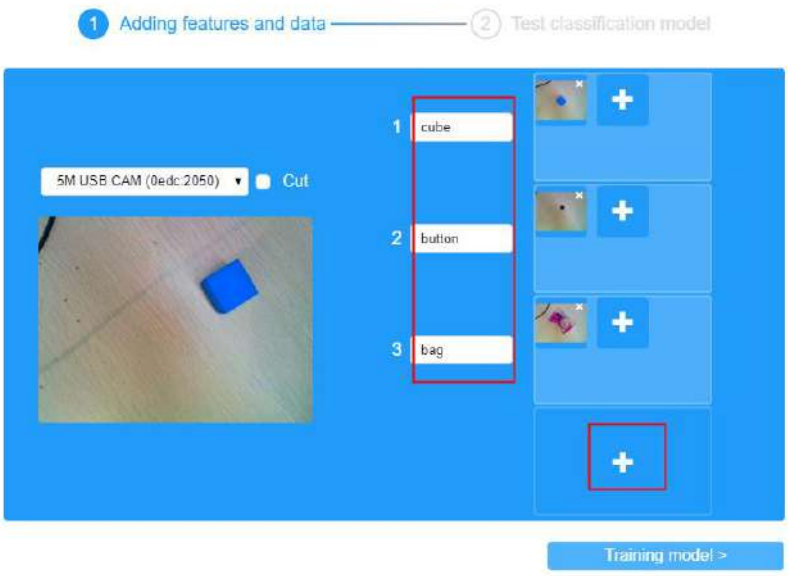


Figure 5.10 Get image and name it

Step 3 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.

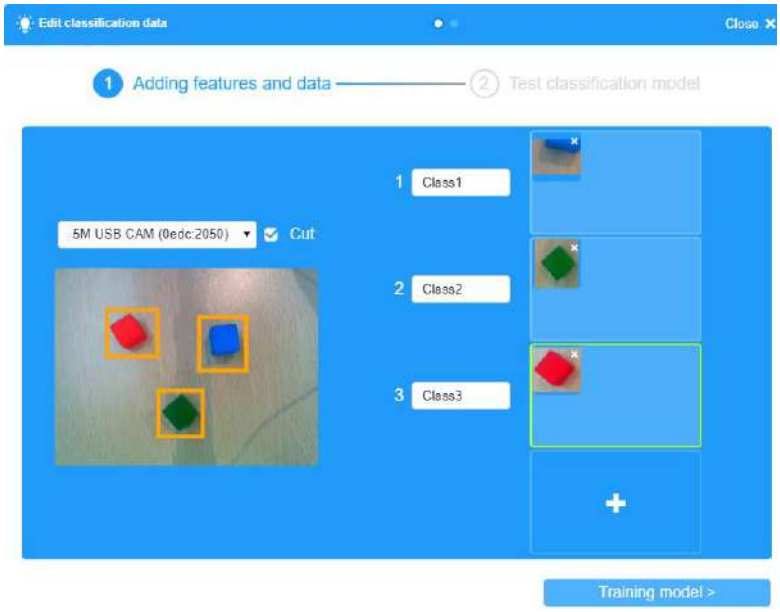


Figure 5.11 Cut picture

Step 4 Click **Training model** to test image, put object below the camera, and the system will match the feature.

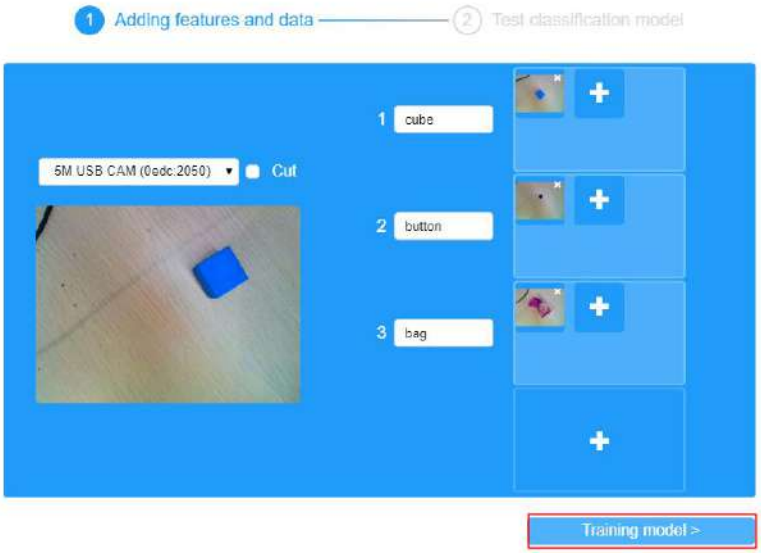


Figure 5.12 Training model

Step 5 Click **Finish** to finish creating image.

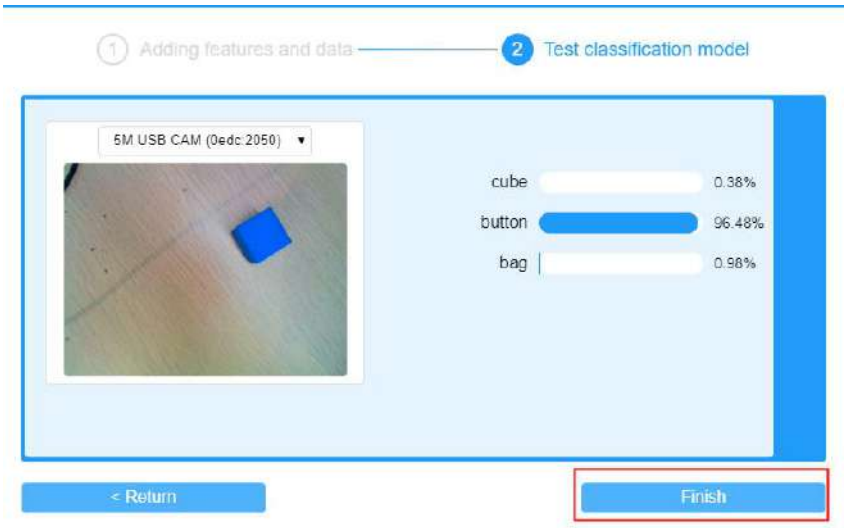


Figure 5.13 Finish model

Table 5.43 Image tag recognition

Instruction	
Description	Recognize image tag
Parameter	Put an image into the module
return	Image tag
Example	Please refer to Table 5.41

Table 5.44 Cut and recognize image

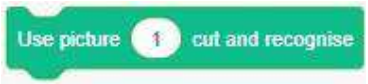
Instruction	
Description	Cut and recognize image
Parameter	Put an image into this module
return	None
Example	Click **space** key to execute program. If the picture's tag is **home**, this program will make robot execute home function

Table 5.45 Get the number of image which is cut

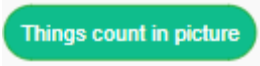
Instruction	
Description	Get the number of items after cutting the image
Parameter	None
return	cutting number
Example	Please refer to Table 5.44

Table 5.46 Get number of picture which is cut

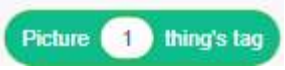
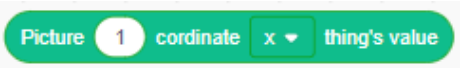
Instruction	
Description	Get the cutting image tag after cutting the image
Parameter	Picture number：Set the cutting image number
return	Image tag
Example	Please refer to Table 5.44

Table 5.47 Get coordinate of picture

Instruction	
Description	Get the coordinate of the cutting image
Parameter	Picture number：Set the cutting image number coordinate：Select axis
return	Coordinate value
Example	Please refer to Table 5.44

5.2.2.4 **Face Recognition**

Table 5.48 Sexual recognition

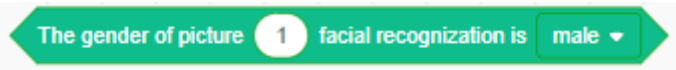
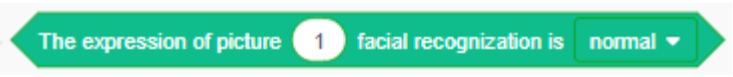
Instruction	
Description	Recognize sexual via face data
Parameter	Face data：Put face data into the module Sexual：male, female
return	True：Recognize successfully False：Recognize failed
Example	Click **space** key to recognize a person' sexual and expression. 

Table 5.49 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 5.48

Table 5.50 Get name

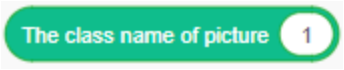
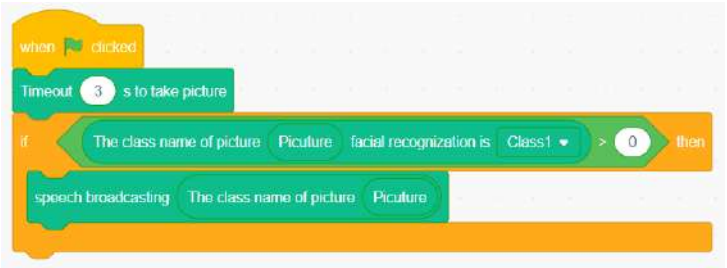
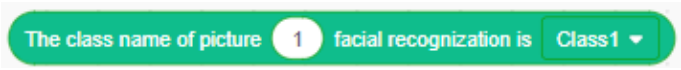
Instruction	
Description	Get name via face data
Parameter	Put face data into the module
return	Name
Example	Click  to execute program. If the picture match is greater than 0, broadcast picture's name 

Table 5.51 Face match

Instruction	
Description	Get face match result
Parameter	Face: Put face data into the module Name: Select matched name
return	Match range: 0% - 100%
Example	Please refer to Table 5.50

5.2.2.5 **OCR Recognition**

Table 5.52 OCR recognition

Instruction	
Description	Recognize the text in the 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**, this program will broadcast **hahahahahaha** 

5.2.3 Photoelectric and Color Sensor

Table 5.53 Set infrared sensor state

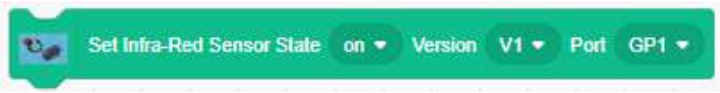
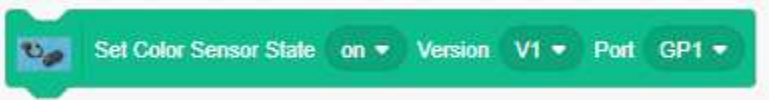
Instruction	
Description	Set infrared sensor status
Parameter	Status: on or off Version: Select the sensor version Port: Select the port where the sensor is connected to the robot
Return	None

Table 5.54 Get infrared sensor value

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

Table 5.55 Set color sensor status

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 5.56 Get color sensor value

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

5.3 Magic Box

Table 5.57 Output digital signal pin value

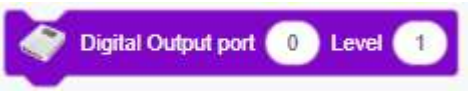
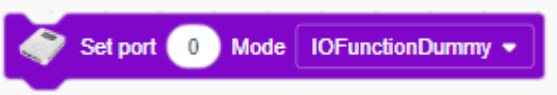
Instruction	
Description	Output digital signal pin value
Parameter	Output port: Set digital output port Level: 1: high level; 0: low level
Return	None

Table 5.58 Set pin state

Instruction	
Description	Set port status
Parameter	port: Select the port according to the function type

	Function type: • IOFunctionDummy • IOFunctionDO • IOFunctionDI • IOFunctionPWM • IOFunctionADC • IOFunctionDIPU • IOFunctionDIPD
Return	None

Table 5.59 Set PWM output

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

Table 5.60 Read the value of a digital signal

Instruction	
Description	Read the value of a digital signal
Parameter	port: Digital port
Return	1：high level, 0：low level

Table 5.61 Read the value of a digital signal

Instruction	
Description	Read the value of a digital signal
Parameter	port: Digital port
Return	True: Read successfully false: Read failed

Table 5.62 Read the value of an analog signal

Instruction	
Description	Read the value of an analog signal
Parameter	port: Analog port
Return	0-4095

Table 5.63 Set stepper motor speed

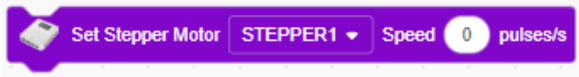
Instruction	
Description	Set stepper motor speed
Parameter	Motor: Select motor Speed: Motor speed (pulse/s)
Return	None

Table 5.64 Set the number of stepping motor speed pulses

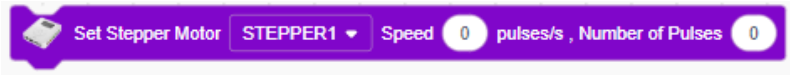
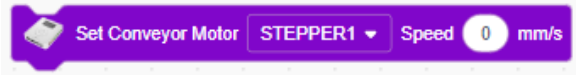
Instruction	
Description	Set the number of stepping motor speed pulses
Parameter	Motor: Select motor Speed: Set motor speed (pulse/s) Pulse number: Set the motor pulses
Return	None

Table 5.65 Set the conveyor motor speed

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

5.4 Mobile Platform

5.4.1 Mobile Platform

Table 5.66 Initialize the mobile platform

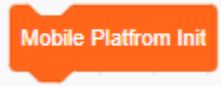
Instruction	
Description	Initialize the mobile platform
Parameter	None
Return	None

Table 5.67 Initialize the mobile platform key

Instruction	
Description	Initialize the mobile platform key
Parameter	None
Return	None

Table 5.68 Set LED state

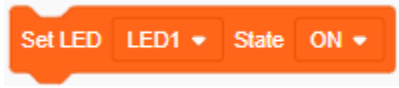
Instruction	
Description	Set LED state
Parameter	Select LED: • LED1 • LED2 • LED3 • LED4 Set state: • ON • OFF • BLINK
Return	None

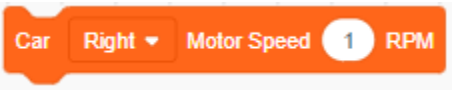
Table 5.69 Set the movement direction and speed of the car

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

Table 5.70 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	None

Table 5.71 Set the motor speed

Instruction	
Description	Set the motor speed
Parameter	Select motor: • Right • Left

	Speed: Set the motor speed, Value range: 0 - 160rpm
Return	None

Table 5.72 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

5.4.2 Sensor

Table 5.73 Start ultrasonic sensor

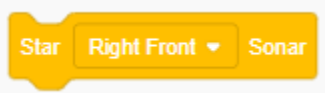
Instruction	
Description	Start ultrasonic sensor
Parameter	Select sensor • Right Front • Front • Left Front
Return	None

Table 5.74 Detect obstacle

Instruction	
Description	Detect obstacle
Parameter	Select sensor: • Right Front • Front • Left Front
Return	true: Obstacle detected

	false: No obstacle detected

Table 5.75 Get detection distance

Instruction	
Description	Obtain the distance between the car and the obstacle
Parameter	Select sensor: • Right Front • Front • Left Front
Return	Distance

Table 5.76 Get the infrared sensor data

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

Table 5.77 Set the white balance of color sensor

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

Table 5.78 Set color sensor status

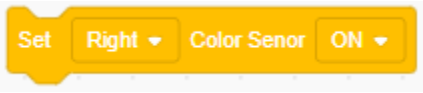
Instruction	
Description	Set color sensor status
Parameter	Select color sensor: • Right • Left Status: • ON • OFF
Return	None

Table 5.79 Get RGB value

Instruction	
Description	Obtain the color value
Parameter	Select color sensor: • Right • Left Color: • Red • Green • Blue
Return	Color value. Value range: 0 - 255

Table 5.80 Detect color

Instruction	
Description	Detect whether the color sensor detects color data
Parameter	Select color sensor: • Right • Left

	Color: • Red • Green • Blue
Return	True: Color detected False: No color detected

Table 5.81 Get the switch status

Instruction	
Description	Get the switch status
Parameter	Select button: • 1 • 2
Return	1：Press 0：Release

Table 5.82 Get the motor angle

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

Table 5.83 Set the ultrasonic sensor detection threshold

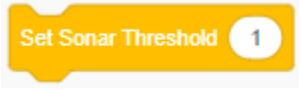
Instruction	
Description	Set the detection threshold of ultrasonic sensor
Parameter	Threshold: Set the detection threshold, value range: 0 - 51.2cm
Return	None

Table 5.84 Set position offset

Instruction	
Description	Set the position offset corresponding to the infrared sensor
Parameter	IR: • IR1 • IR2 • IR3 • IR4 • IR5 • IR6 Set offset: Set the offset of each infrared sensor. To ensure that the mobile platform keeps running along the black line, you need to set the 6 infrared sensors offsets to symmetric data centered at 0, for example: -3, -2, -1, 1, 2, 3
Return	None

Table 5.85 Get the infrared sensor offset

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

Table 5.86 Get the infrared sensor offset after PID processing

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

Table 5.87 Se PID parameters

Instruction	
Description	Set PID parameters
Parameter	KP: Scale factor. Value range: 0.5- 5 KI: Integration factor. Value range: 0.05 - 0.5 KD: Differential factor Accumulated error
Return	Return offset

5.5 Arduino

5.5.1 Serial Port

Table 5.88 Set pin mode

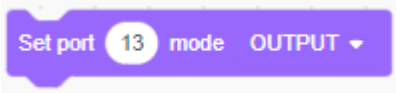
Instruction	
Description	Set port mode
Parameter	port: Port index Select mode: • OUTPUT • INPUT • INPUI_PULLUP
Return	None

Table 5.89 Set baud rate for serial data transmission

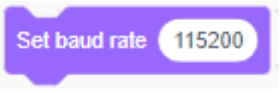
Instruction	
Description	Set baud rate for serial data transmission
Parameter	Baud rate: Set the baud rate for data transmission
Return	None

Table 5.90 Set baud rate for Xbee data transmission

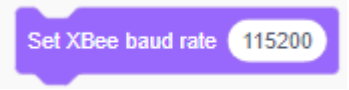
Instruction	
Description	Set baud rate for Xbee data transmission
Parameter	Baud rate: Set the baud rate for Xbee data transmission
Return	None

Table 5.91 Serial print

Instruction	
Description	Serial print
Parameter	Set data to be printed
Return	None

Table 5.92 Serial line feed

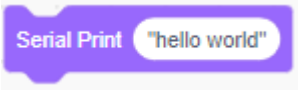
Instruction	
Description	Serial line feed
Parameter	Set data to be printed
Return	None

Table 5.93 Get serial value

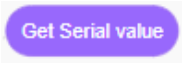
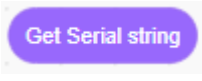
Instruction	
Description	Get data from serial port
Parameter	None
Return	Data byte

Table 5.94 Get serial string

Instruction	

Description	Get string from serial port
Parameter	None
Return	String

5.5.2 IO Operation

Table 5.95 Set Arduino digital level

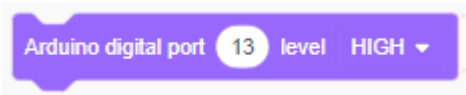
Instruction	
Description	Set Arduino digital level
Parameter	port: Digital port level: HIGH or LOW
Return	None

Table 5.96 Set analog pin value

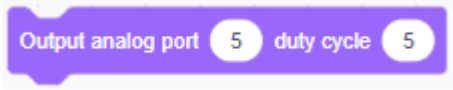
Instruction	
Description	Write analog value to the specified analog port for controlling the brightness of the LED indicator or the speed of the motor
Parameter	port: Analog port duty cycle: Value range: 0-255
Return	None

Table 5.97 Read digital port value

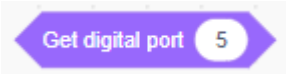
Instruction	
Description	Read digital port value
Parameter	port: Digital port
Return	True: Read successfully False: Read failed

Table 5.98 Read digital port value

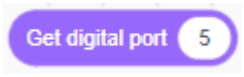
Instruction	
Description	Read digital signal pin value
Parameter	port: Digital port
Return	0: Low level 1: High level

Table 5.99 Read analog port value

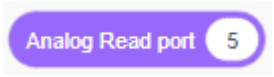
Instruction	
Description	Read analog port value
Parameter	port: Analog port
Return	0-4095

Table 5.100 Set the output frequency and output duration of the ultrasonic port

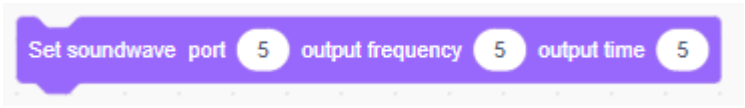
Instruction	
Description	Set the output frequency and output duration of the ultrasonic port
Parameter	• port: Ultrasonic port • Output frequency. Value range: 31~65535HZ • Output duration. Value range: 0~4294967295 us
Return	None

Table 5.101 Set angle of the servo motor

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

5.5.3 Vision Recognition

You need to initialize it before using the vision kit. If you have saved the initialization data, you can click Import Initialization Data to import to initialize it. Otherwise, please click Init Visual Sort to complete the initialization according to the tips. The initialization steps are as follows.

Step 1 Follow the prompts to complete the initialization.

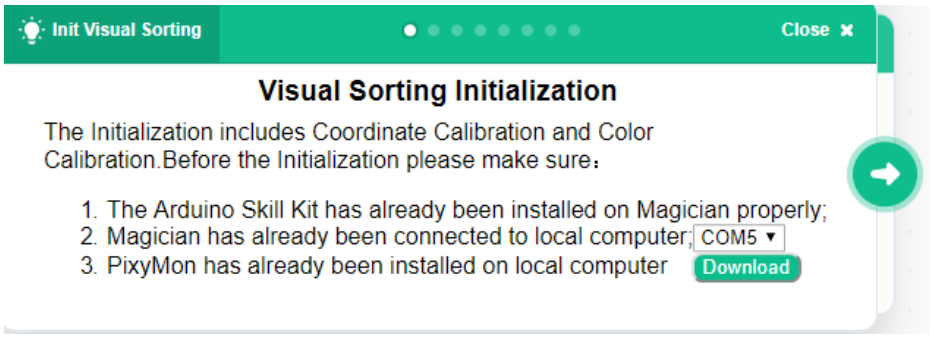


Figure 5.14 Vision sorting initialization

⚠NOTICE

Please download and install **PixyMon** according to different PC systems.

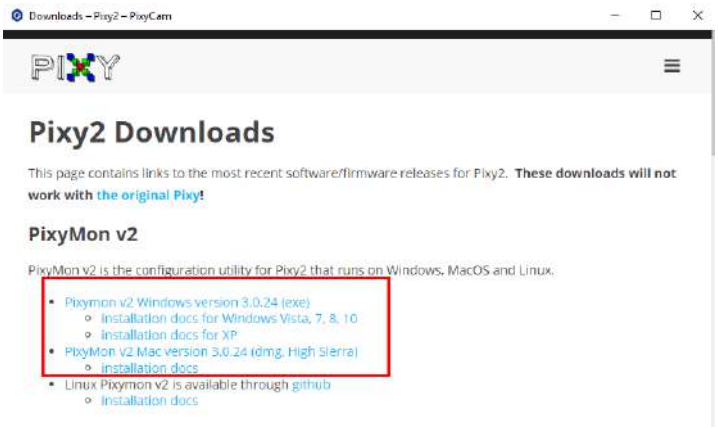


Figure 5.15 Download PixyMon

Step 2 Move the robot arm till the suction cup is tightly in contact with the base and click **Record** button to record the base level.

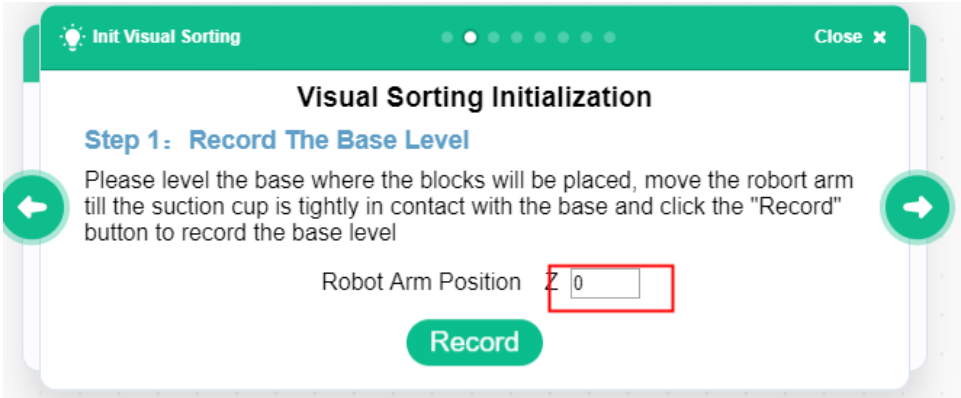


Figure 5.16 Record base level

Step 3 Set different color blocks' height based on site requirements, and then click "Record".

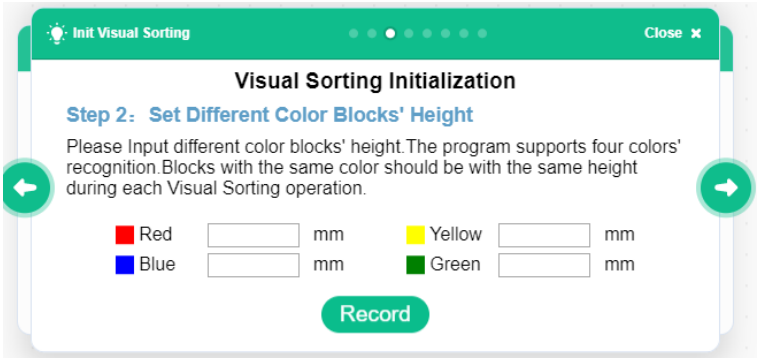


Figure 5.17 Record block height

Step 4 Move the camera to the vision recognition position, click **Record** to obtain the position of the robot arm or manually input them and then click **Record**.

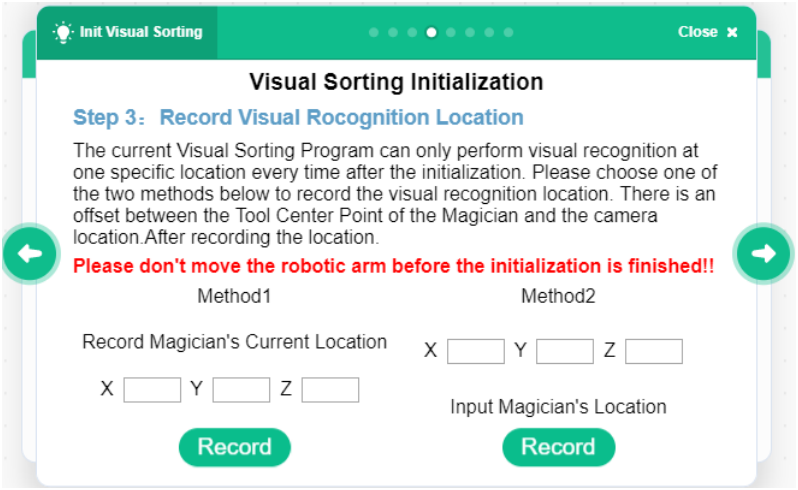


Figure 5.18 Record recognition position

Step 5 Record values of the PixyMon calibration point. Follow the prompts to place the

three calibration blocks into the camera's field of view. Click **Action** on the PixyMon page and repeatedly use the Signature1 to select three blocks, and write the coordinates, height and width of the blocks according to the box selection results, and click **Record**.

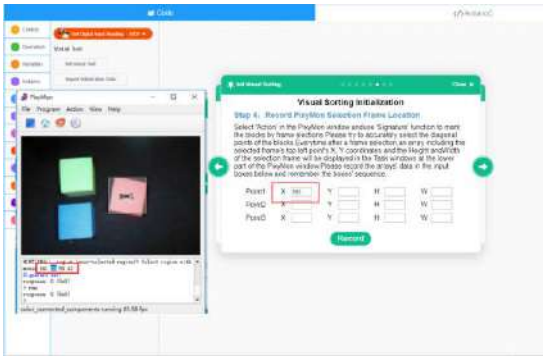


Figure 5.19 Record calibration position

⚠NOTICE

Before using Signature1 to select blocks, you need to click **View > Console**.

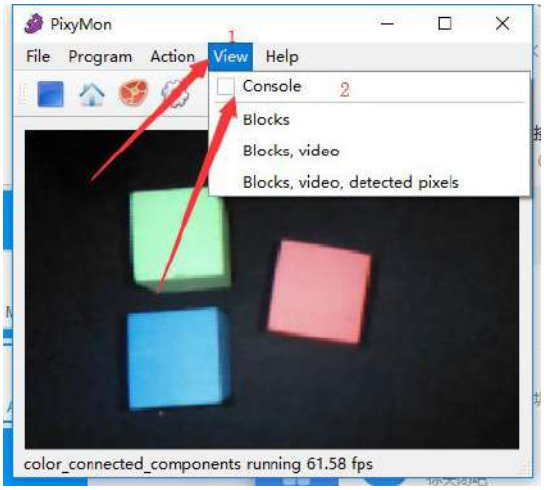


Figure 5.20 open console

Step 6 Record coordinates of the calibration blocks. Move the robot arm till the suction cup is tightly in contact with the center of the three blocks separately and click **Record** to record the coordinates of the three blocks.

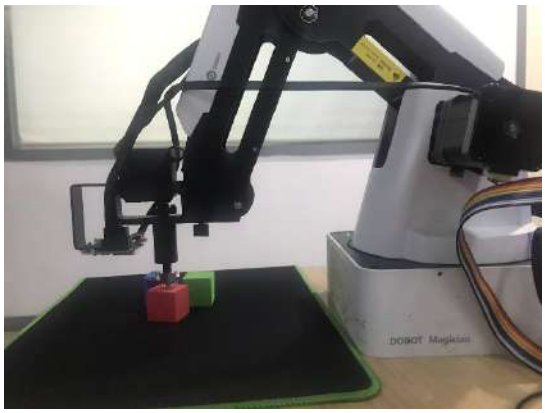


Figure 5.21 Move the robot arm to the center of the three blocks

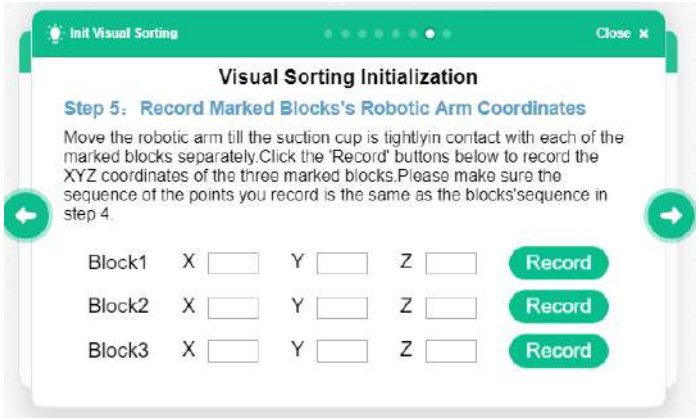


Figure 5.22 Record position

Step 7 Color calibration. Put the blocks with colors that needs to be recognized in the field of vision, click **Action** according to the prompt and use Signature1, 2, 3, 4 to mark corresponding colors, and match the colors and signatures in the option box.

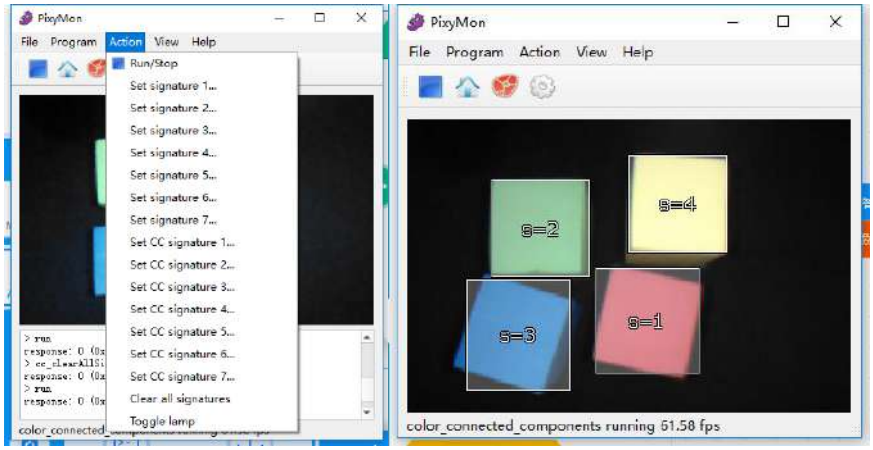


Figure 5.23 Select block

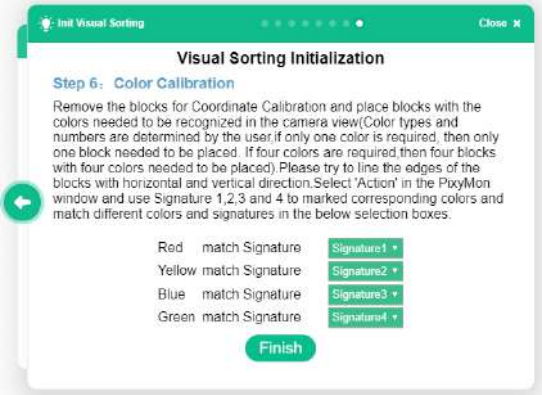


Figure 5.24 Color matching

5.5.4 Speech Recognition

Table 5.102 Initialize speech recognition module

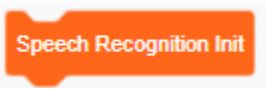
Instruction	
Description	Initialize speech recognition module
Parameter	None
Return	None

Table 5.103 Add speech

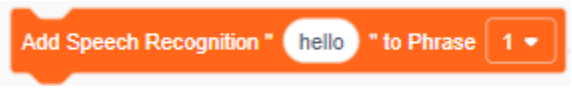
Instruction	
Description	Add speech to speech recognition module
Parameter	Voice content: Edit voice content Phrase: Select the speech recognition phrase number
Return	None

Table 5.104 Detect voice module

Instruction	
Description	Detect voice module
Parameter	Select speech recognition number

Return	True: Voice detected False: No speech detected

5.5.5 JoyStick

Table 5.105 Get button status

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

Table 5.106 Set LED status

Instruction	
Description	Set LED status
Parameter	Select LED: • Red • Green • Blue Status: • ON • OFF
Return	None

Table 5.107 Get LED status

Instruction	
Description	Check LED status

Parameter	Select LED • Red • Green • Blue
Return	True: ON False: OFF

Table 5.108 Read Joystick value

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

Table 5.109 Check Joystick status

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

5.6 AIStarter

5.6.1 AIStarter

Table 5.110 Initialize AI-Starter

Instruction	
Description	Initialize AI-Starter
Parameter	None
Return	None

Table 5.111 Initialize switch

Instruction	
Description	Initialize switch
Parameter	None
Return	None

Table 5.112 Set LED status

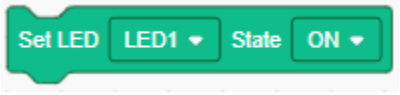
Instruction	
Description	Set LED status
Parameter	Select LED: • LED1 • LED2 Set status: • ON • OFF • BLINK
Return	None

Table 5.113 Set PID

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

5.6.2 Motion

Table 5.114 Set motor speed

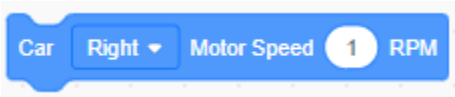
Instruction	
Description	Set motor speed
Parameter	Select the motor • LEFT • RIGHT Speed: Set the motor speed. Value range: 0r/m - 100r/m
Return	None

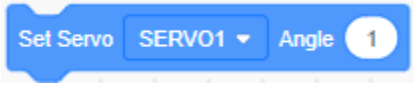
Table 5.115 Attach sever

Instruction	
Description	Turn on tipper-hopper mode. Namely, the car upload objects
Parameter	Select servo
Return	None

Table 5.116 Detach servo

Instruction	
Description	Turn off tipper-hopper mode
Parameter	Select servo
Return	None

Table 5.117 Set servo angle

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

5.6.3 **Sensor**

Table 5.118 Start ultrasonic sensor

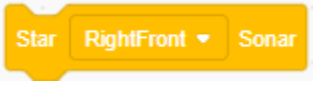
Instruction	
Description	Start ultrasonic sensor
Parameter	Sensor: • Right front • Front • Left front
Return	None

Table 5.119 Detect obstacle

Instruction	
Description	Detect whether an obstacle is exist in front of AI-Starter. Before calling this module, please start the corresponding ultrasonic sensor
Parameter	Direction: • Right front • Front • Left front
Return	true: There is an obstacle false: There is no obstacle

Table 5.120 Get ultrasonic sensor data

Instruction	
Description	Get the distance between AI-Starter and barrier.
Parameter	Sensor: • Right front • Front • Left front
Return	Detection distance

Table 5.121 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 5.122 Get geomagnetic angle

Instruction	
Description	Get geomagnetic angle
Parameter	None
Return	Geomagnetic angle

Table 5.123 Set calibration

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

Table 5.124 Set white balance of color sensor

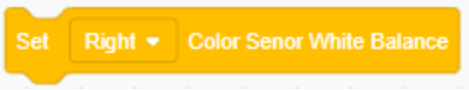
Instruction	
Description	Set white balance of the color sensor
Parameter	Color sensor: • Right • Left
Return	None

Table 5.125 Set color sensor status

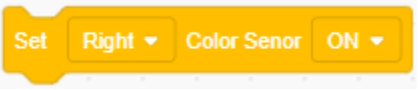
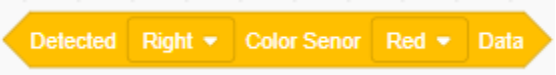
Instruction	
Description	Set color sensor status
Parameter	Color sensor: • Right • Left Status: • ON • OFF
Return	None

Table 5.126 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 5.127 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 5.128 Get Switch status

Instruction	
Description	Get switch status
Parameter	Switch: • Switch 1 • Switch 2 • Switch 3
Return	true: Press false: Release

Table 5.129 Get photosensitive value

Instruction	
Description	Get photosensitive value
Parameter	None
Return	Photosensitive value. Value range: 0 - 4096

Table 5.130 Set ultrasonic sensor threshold

Instruction	
Description	Set ultrasonic sensor threshold
Parameter	Ultrasonic sensor threshold. Value range: 0~51.2cm
Return	None

Table 5.131 Set the position offset

Instruction	
Description	Set the position offset corresponding to the infrared sensor
Parameter	IR: • IR1 • IR2 • IR3 • IR4 • IR5 • IR6 Set offset: Set the offset of each infrared sensor. To ensure that the mobile platform keeps running along the black line, you need to set the 6 infrared sensors offsets to symmetric data centered at 0, for example: -3, -2, -1, 1, 2, 3
Return	None

Table 5.132 Get the infrared sensor offset

Instruction	
Description	Get the infrared sensor offset after setting it
Parameter	None
Return	Return offset

Table 5.133 Get the infrared sensor offset after PID processing

Instruction	
Description	Get the infrared sensor offset after PID processing

Parameter	None
Return	Return offset

Table 5.134 Get the infrared sensor offset

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

Table 5.135 Get motor pose

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

Table 5.136 Se PID parameters

Instruction	
Description	Set PID parameters
Parameter	KP: Scale factor. Value range: 0.5- 5 KI: Integration factor. Value range: 0.05 - 0.5 KD: Differential factor Accumulated error
Return	Return offset

5.6.4 Xbee

Table 5.137 Get Xbee value

Instruction	
Description	Get Xbee value
Parameter	None
Return	Xbee value

Table 5.138 Send Xbee value

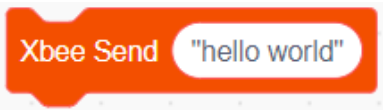
Instruction	
Description	Send Xbee values
Parameter	Value: Set the value to be sent
Return	None

Table 5.139 Clear Xbee cache

Instruction	
Description	Clear the Xbee cache
Parameter	None
Return	None

