

DobotBlock User Guide

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Shenzhen Yuejiang Technology Co., Ltd



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The user has the responsibility to make sure following the relevant practical laws and regulations of the country, in order that there is no significant danger in the use of the robotic arm.

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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 |
|--------|---|
| | Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury |
| | 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 |
| | Indicates a potentially hazardous situation which, if not avoided, can result in robotic arm damage, data loss, or unanticipated result |
| | Provides additional information to emphasize or supplement important points in the main text |



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User Guide



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

| 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 |

| Table 1 1 | Homepage | description |
|-----------|-----------|-------------|
| | riomepage | ucscription |



2. Devices and Extension Center

We will introduce the device lib and extension center in this chapter, you can click of 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

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 O on the DobotBlock page and then select Magician Lite on the Choose a Device page.
- Step 4 Click Stop to connect Magician Lite and DobotBlock.

| MagicianLite | * |
|---------------------------------------|---------|
| Port Name COM5 | Connect |
| | |
| | |
| Select your device in the list above. | |
| | |
| Refresh | |

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 row to move Magician Lite to the homing point.



| | 📼 Code | |
|--|--------|-----|
| Gannes Varannes Samme | | |
| Costing Costing Marine Shatat | | |
| Contrana Contration | | |
| | | |
| | | |
| | | GED |

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.

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```



| 😑 Gantrol | MogicianLife |
|----------------|--|
| Operators | A Hore |
| 😑 Variables | A Select End Effective Entroper + |
| Sansing | A Ed Motor Velocity Faab 100 14 |
| 😑 Events | |
| Megic Bax | A Sol Army Height (1) mm |
| 🆩 MegiclanLite | Sair Eand Shep Throatede 🕦 ' |
| My Blocks | A Huns |
| | A Gala lli X (1) Y (1) Z (1) D (1) LMNN Typel Lan * A Set Median Machine Rate (10) % |
| | 🗛 Roldsve Move ΔX 💿 mm ΔZ 💿 mm ΔZ 💿 mm ΔR 💿 🔸 🗛 Jamp To X. 50 Y 50 Z 🕐 R 6 |
| | A first kind Step |
| | 🔨 Mens Joints to Junit 🕐 * Jant2 🚱 * Jant2 💽 * Jant3 💽 * |
| | No. Sudan Car on - |
| | A Disper Delp+ |
| | - A Get Current Geordinate x - |
| | Call Clariner Sciet Auges - Scient - |
| | Clear Ad Alvania State |
| | A |

Figure 3.4 Drag blocks to the block area

| Step 3 | Click | on the Magic Box page to switch the offline mode. |
|--------|-------|---|
| | | |
| | | Coordiate |
| | | X 0 Y 0 Z 0 R 0 |
| | | |
| | | LinearRail L- L+ |

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. Al 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 **t** 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.

| Adding features and data — | 2 Test clas | sification model |
|--|---------------------|------------------|
| 5M USB CAM (0edc:2050) • | | 10000 |
| Will all to part of the | Square Rectangle | 0.57% |
| | Circle | 0.21% |
| | | |
| | | |

Figure 4.3 Circle matching



Figure 4.4 Rectangle matching

```
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```



| (1) Adding features and data — | Test clas | ssification model |
|--------------------------------|-----------|-------------------|
| O Making routines and data | | |
| 5M USB CAM (0edc:2050) • | | |
| | Square | 97.83% |
| and the second | Rectangle | 0.61% |
| | Circle | 0.44% |
| the state of the second states | | |
| | | |
| | | |
| | | |
| | | |

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.



| when 🛸 clicked | | |
|--------------------|--|------|
| Intever | | |
| 🔨 Јитр То Х (| 2138 Y 219 Z 169 R 34 | |
| speech broadcastin | Helia, please put an object below the camera | |
| Timeoul 5 s to | o fake picture | |
| # Does string | g Picture recognize Picture 's tag contain Rectangle | thee |
| speech broadcas | ting Rectangle | |
| A Jump To > | 258.9 Y 30.7 2 -69.1 R 63 | |
| -A Suction Ci | up ON + | |
| A Jump To X | A 1794 Y 2045 Z 591 R 244 A | |
| Suction C | up DFF V | |
| | | - |
| if Does shing | g Picture recognize Picture 's lag contain Gircle then | |
| speech broadcas | ting Circle | |
| Jump To X | (258.9 Y 39.7 Z -66.1 R 6.3 | |
| -A Suction C | up ON 🔫 | |
| Jump To X | (113.0 Y 244.9 2 59.1) R 24.4 B | |
| -A Suction C | up OFF = | |
| - Annual | | 4 |
| I Does string | g Picture recognize Picture 's tag contain Square the | 41 |
| speech hmadcas | sting Square | |
| -🕰 Jump To X | 258.9 Y 397 Z 481 R 63 | |
| Suction C | the second s | |
| Jump To X | (9.5 Y -244.9 Z -59.1 R -24.4 C | |
| -A Suction C | up OFF + | |
| wait 3 second | | |
| | | |

- 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 **N** 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.

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| О ровот | DobotBlock User Guide | 4 AI Camera Description |
|--------------|---|-------------------------|
| | Face recognition New face data The gender of picture 1 facial recognizatio | |
| | The expression of picture 1 facial recogniz The class name of picture 1 The class name of picture 1 facial recogniz | |
| | Figure 4.6 Create face data | |
| Step 2 Click | get face data and name it. Adding features and data(2) Test classification | |
| | 1 Name1 + | |
| | + | |
| | ① Delete categorical data | |

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.

| 🔶 Edit face data | • | Close × |
|------------------------------|------------------------|----------------|
| (1) Adding features and data | Test classif | ication model |
| 5M USB CAM (Dedc:2050) • | Name1 Name4 Test | 0.15% 0.29% |
| < Return | | Finish |

Figure 4.9 Train model

4.3.2 Program Creating



| out 3 | s to take picture | | | | | | | | | | | | | |
|----------|-------------------|------------|---------------|------------|----------|---------|-------------|----------------|-------|-------|--------|-----------|------------|--|
| The | gender of picture | Picture | facial recogn | ization is | female 💌 | and | The express | ion of picture | Pictu | re fa | al rec | gnization | is smile • | |
| ech broa | dcasting This is | a smilling | girl | | | | | 14 | | | 1 | | | |
| 17 | | nichure | Picture facia | Imeania | ation is | lace1 - | > 90 1 | hen | | | | | | |
| < (T | | | i luige laua | riecogniss | | 1551 | 30 | | | | | | | |
| 50 | ne class name of | | | | | | | | | | | | | |
| <0 | ne class name of | | | | | | | | | | | | | |

Figure 4.10 Program

Click **R** 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.

| | nen 🏴 clicked | | | | | | | | | |
|---|---------------------|------------|-------------|-----------|-------|--------|------|-----|-------|-----|
| | ien 🧧 cicked | | | | | | | | | |
| | meout 3 s to tak | e picture | | | | | | | | |
| CR recognize picture Picture words contain Detect the | 1. | | | | | 10 | | - | | |
| | Does string (| OCR recogn | ize picture | e Picture | e wo | ords | cont | ain | Detec | the |
| | | | | | | | | | | _ |
| OCR recognize picture Picture words | | OCR reco | ognize pic | ture Pic | ture | word | s | | | |
| Contrologines picture incluse inclus | speech broadcasting | 00111000 | igines pis | rune ine | ture. | anona. | • | | | |

Figure 4.11 OCR recognition



5. Program Instructions

5.1 Magician/Magician Lite

5.1.1 Setting



Table 5.1 Select end-tool

Table 5.2 Set PTP motion ratio

| Instruction | Set Motion Ratio Velocity 0 % Acceleration 0 % |
|-------------|--|
| 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 | Set Joint Velocity 0 */s Acceleration 0 */s^2 |
|-------------|--|
| 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 |



Instruction Set XYZ Velocity (0) mm/s: Acceleration (0) mm/s*2 \n Set End Effector Velocity (0) */s Acceleration (0) */s*2

Table 5.4 Set the speed and acceleration of the Cartesian axis

| 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 | Set Stepper Motor STEPPER1 - Speed 0 pulses/s |
|-------------|---|
| 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 | Set Jump Height 0 mm zLimit 0 mm |
|-------------|---|
| 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 | Set Lost Step Threshold 0 * |
|-------------|--|
| 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 |

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| Instruction | Set Stepper Motor STEPPER1 Speed pulses/s , Number of Pulses |
|-----------------|---|
| Descriptio n | 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 5.8 Set the number of stepper motor speed pulses



| Instruction | Set Lost Step |
|-------------|------------------------------|
| Description | Perform motor loss detection |
| Parameter | None |
| Return | None |



| Instruction | Set Conveyor Motor STEPPER1 - Speed 0 mm/s | |
|-------------|---|--|
| 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 | Home | | |
|-------------|----------------|------------|--|
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| 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 | Goto X 0 Y 0 Z 0 R 0 Move Type Straight Line - | | |
|-------------|--|--|--|
| 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 5.14Move robot to a target position

| Instruction | Relative Move △X | 0 mm 🛆 Y 🕕 | mm ΔZ 🕕 mm ΔR 🕕 * |
|---|------------------------------|------------|--|
| Description | Move robot to a target posit | ion | |
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| Parameter | $\triangle X$: Set X-axis increment value |
|-----------|--|
| | \triangle Y: Set Y-axis increment value |
| | \triangle Z: Set Z-axis increment value |
| | $\triangle R$: Set R-axis increment value |
| Return | None |



| Instruction | Move Joints to Joint1 0 ° Joint2 0 ° Joint3 0 ° Joint4 0 ° |
|-------------|--|
| 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 | Set R 0 * |
|-------------|------------------------------|
| Description | Set R-axis rotation angle |
| Parameter | R: Set R-axis rotation angle |
| Return | None |



| Instruction | Suction Cup ON - | | |
|-------------|------------------------|----------|--|
| Description | Set suction cup status | | |
| Parameter | Suction cup status: | | |
| | • ON | | |
| | • OFF | | |
| Return | None | | |
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Table 5.18 Set gripper status

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

5.1.3 **Detection**



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

| Table 5.20 | Get robot | joint coordinates |
|------------|-----------|-------------------|
|------------|-----------|-------------------|

| Instruction | Get Current Joint Angle Joint1 - |
|-------------|---|
| 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 | Check Lost Slep |
|-------------|---------------------------------|
| Description | Detect whether robot loses step |
| Parameter | None |
| Return | True: step lost |
| | False: no step lost |

Table 5.22 Clear robot alarm

| Instruction | Clear Alarm |
|-------------|-------------------|
| Description | Clear robot alarm |
| Parameter | None |
| Return | None |

5.1.4 I/O (Only Magician Supported)

Table 5.23 Set EIO state

| Instruction | Set Pin EIO1 - Mode IOFunctionDummy - |
|-------------|--|
| 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 | Set PWM Output Port EIO1 - Frequency 0 Duty 0 % | |
|-------------|--|--|
| 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 5.25Set digital output to high or low

| Instruction | Set digital Output Port EIO1 - Value HIGH - |
|-------------|---|
| 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 | Get Digital Input Reading EI01 - |
|-------------|-----------------------------------|
| 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 | Get Analog Input Reading EIO1 - |
|-------------|-----------------------------------|
| Description | Get the value of an analog signal |
| Parameter | EIO: Select EIO |
| Return | 0-4095 |

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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.

| Coordinate calibration | | Close 🗙 |
|--------------------------------|---|--|
| ③ Please place the calibration | card in the middle of the camera's | s view. |
| | Note: Please place calibration card accordin frame as shown in the so the four calibration point and D appear on the scr position of the calibration | g to the blue creen. When s A, B, C, een, fix the |
| Prev | Ne | xt |

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

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

MNOTE

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 | SetLinearRail IsEnable on Version V1 | |
|-------------|---|--|
| 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 | |

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Return None

Table 5.29 Get sliding rail state

| Instruction | Get Linear Rail State |
|-------------|------------------------|
| Description | Get Sliding rail state |
| Parameter | None |
| Return | None |

Table 5.30 Move the sliding rail a certain distance

| Instruction | MoveLinearRailTo 0 mm |
|-------------|--|
| 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 | Set Linear Rail Point To Point Mode Velocity 0 Acceleration 0 |
|-------------|---|
| 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 | Set Linear Rail Jogging Mode Velocity 0 Acceleration 0 | |
|-------------|--|--|
| 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 | |
| | | |

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Return None

Table 5.33 Get the speed and acceleration in PTP mode

| Instruction | Get Linear Rail Point to Point Mode Speed - | |
|-------------|---|--|
| Description | Get the speed and acceleration in PTP mode | |
| Parameter | Select the parameter speed (mm/s) or acceleration (mm/s 3 | |
| Return | Speed or acceleration | |

Table 5.34 Get the speed and acceleration in jogging mode

| Instruction | Get Linear Rail Jogging Mode Speed - | |
|-------------|---|--|
| Description | Get the speed and acceleration in jogging mode | |
| Parameter | Select the parameter speed (mm/s) or acceleration (mm/s 3 | |
| Return | Speed or acceleration | |

Table 5.35Get sliding rail position

| Instruction | Get Linear Rail Position |
|-------------|----------------------------|
| 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.

| Speech recognition | | Close 🗙 |
|--------------------|-----------------------|---------|
| | | |
| | | |
| | | |
| Please select | a language: English 🔻 | Start |
| | | |

Figure 5.7 Start recognition

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

| Speech recognition | Close 🗙 |
|---------------------------------------|---------|
| | |
| | |
| | - |
| Please select a language: English ▼ S | top |



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

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|---------------------------|------------|--|
| | 27 | |



speech recognition results

results module

| Table 5.36 | Recognize speech automatically |
|------------|--------------------------------|
|------------|--------------------------------|

| Instruction | start Chinese_putonghua voice recognition, continued for 1 second | | |
|-------------|---|--|--|
| 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 | | |



| Instruction | start Chinese_putonghua - voice recognition, Manual |
|-------------|---|
| 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 |

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Table 5.38 Speech recognition result

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



| Instruction | speech broadcasting hello |
|-------------|---------------------------------------|
| 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 | Timeout 3 s to take picture |
|-------------|--|
| 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. |



| Timeout 3 s | to take picture | | | | | |
|--------------|----------------------|----------|--------|---------|------|--|
| if Does stri | ng Picture recognize | Picuture | 's tag | contain | Home | |

Table 5.41 Get image manually

| Instruction | Take pictual manually | | |
|-------------|--|--|--|
| 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 | Picuture |
|-------------|----------------------------|
| 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.

| Image Identification |
|---------------------------------------|
| Edit classification data |
| Picture recognize 1 's tag |
| Use picture 1 cut and recognise |
| Things count in picture |
| Picture 1 thing's tag |
| Picture 1 cordinate x thing's value |

Figure 5.9 Edit classification data

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

| Adding features and data —— | 2 |) Test classification model |
|------------------------------|-----------------------------|-----------------------------|
| 5M USB CAM (0ed: 2050) • Cut | 1 cube 2 button 3 bag | |
| | | + Training model > |

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.

| 1 Adding features and data — | -C |) Test classification model |
|--------------------------------|----------|-----------------------------|
| | 1 cube | • + |
| 5M USB CAM (0edc:2050) 🔹 📄 Cut | 2 button | III + |
| | 3 bag | 1 |
| | | + |
| | | Training model > |

Figure 5.12 Training model

Step 5 Click Finish to finish creating image.


| 5M USB CAM (0edc 2050) 🔹 | | |
|---|--------|--------|
| a full of a | cube | 0.38% |
| | button | 96.48% |
| | bag | 0.98% |
| | | |
| | | |
| ALL AND | | |

Figure 5.13 Finish model



| Instruction | Picture recognize 1 's tag |
|-------------|------------------------------|
| 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 | Use picture 1 cut and recognise |
|-------------|---|
| 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 | Things count in picture |
|-------------|---|
| 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 Ge | number of picture which is cut |
|---------------|--------------------------------|
|---------------|--------------------------------|

| Instruction | Picture 1 thing's tag |
|-------------|---|
| 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 5.47Get coordinate of picture



| Instruction | Picture 1 cordinate x thing's value |
|-------------|---|
| 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



| Instruction | The gender of picture 1 facial recognization is male - |
|-------------|--|
| 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 | The expression of picture 1 facial recognization is normal - |
|-------------|--|
| Description | Recognize expression via face data |
| Parameter | Expression: Normal Smile Laugh |
| return | True: Recognize successfully False: Recognize failed |

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Example

Please refer to Table 5.48

Instruction The class name of picture 1 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, broadcasts picture's name Image: The class name of picture To execute program. If the picture match is greater than 0, broadcasts picture's name

Table 5.50 Get name

Table 5.51 Face match

| Instruction | The class name of picture 1 facial recognization is Class1 - |
|-------------|--|
| 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

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| Instruction | OCR recognize picture 1 words |
|-------------|---------------------------------|
| Description | Recognize the text in the image |
| Parameter | Put an image into this module |
| Return | Text |
| | · |

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| 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 |
|---------|---|
| | when space * Key pressed Timeout 3 s to take picture I Does string OCR recognize picture Piculure words contain Laugh then spooch broadcasting hahahahahaha |

5.2.3 **Photoelectric and Color Sensor**

| Table 5.53 | Set infrared sensor state |
|------------|---------------------------|
| | |

| Instruction | Set Infra-Red Sensor State on Version V1 Port GP1 | |
|-------------|--|--|
| 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 | |



| Instruction | Get GP1 - Infra-Red Sensor | |
|-------------|--|--|
| 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 | Set Color Sensor State on - Version V1 - Port GP1 - |
|-------------|---|
| Description | Set color sensor status |

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| 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 | Get red - Color Sensor |
|-------------|------------------------|
| Description | Get color sensor value |
| Parameter | Select color: |
| | • Red |
| | • Green |
| | • Blue |
| Return | Color value |

5.3 Magic Box



| Instruction | Digital Output port 0 Level 1 |
|-------------|--------------------------------------|
| 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 | Set port 0 Mode IOFunctionDummy - | |
|-------------|--|--|
| Description | Set port status | |
| Parameter | port: Select the port according to the function type | |

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|---------------------------|------------|--|
| | | |



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



| Instruction | Set PWM Output port 0 frequency 1 Duty Cycle 1 |
|-------------|--|
| 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 | Digital Read port |
|-------------|------------------------------------|
| Description | Read the value of a digital signal |
| Parameter | port: Digital port |
| Return | 1: high level, 0: low level |



| Instruction | Digital Read port | | |
|------------------------------|------------------------------------|------------|--|
| Description | Read the value of a digital signal | | |
| Parameter | port: Digital port | | |
| Return | True: Read successfully | | |
| | false: Read failed | | |
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Table 5.62 Read the value of an analog signal

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

Table 5.63Set stepper motor speed

| Instruction | Set Stepper Motor STEPPER1 - Speed 0 pulses/s |
|-------------|---|
| 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 | Set Stepper Motor STEPPER1 - Speed 0 pulses/s , Number of Pulses 0 |
|-------------|---|
| 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 | Set Conveyor Motor STEPPER1 - Speed 0 mm/s | |
|-------------|--|--|
| 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

| Instruction | Mobile Platfrom Init |
|-------------|--------------------------------|
| Description | Initialize the mobile platform |
| Parameter | None |
| Return | None |

| Table 5.67 | Initialize the mobile platform key |
|------------|------------------------------------|
|------------|------------------------------------|

| Instruction | Set Key Init |
|-------------|------------------------------------|
| Description | Initialize the mobile platform key |
| Parameter | None |
| Return | None |

Table 5.68 Set LED state

| Instruction | Set LED LED1 - State ON - |
|-------------|---------------------------|
| 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 | Car Ahead Speed 1 |
|-------------|--|
| 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 | Car Ahead • Speed 1 Motion Time 1 Second |
|-------------|---|
| 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 $(0 \sim 255)$ |
| | Time: Set time (seconds) |
| Return | None |

Table 5.71 Set the motor speed

| Instruction | Car Right - Motor Speed | 1 RPM | |
|--------------|-------------------------|------------|--|
| Description | Set the motor speed | | |
| Parameter | Select motor: | | |
| | • Right | | |
| | • Left | | |
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| | Speed: Set the motor speed, Value range: 0 - 160rpm |
|--------|---|
| Return | None |



| Instruction | Set Motor KP 1 KI 1 |
|-------------|---|
| 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



| Instruction | Star Right Front - Sonar |
|-------------|--------------------------|
| Description | Start ultrasonic sensor |
| Parameter | Select sensor |
| | Right Front |
| | • Front |
| | Left Front |
| Return | None |

Table 5.74 Detect obstacle

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



false: No obstacle detected

| Table 3.75 Get detection distance | Table 5.75 | Get detection distance |
|-----------------------------------|------------|------------------------|
|-----------------------------------|------------|------------------------|

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

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

Table 5.77 Set the white balance of color sensor

| Instruction | Set Right - Color Senor white balance |
|--------------|--|
| Description | Set the white balance of color sensor |
| Parameter | Select color sensor: |
| | • Right |
| | • Left |
| Return | None |
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| Instruction | Set Right - Color Senor ON - |
|-------------|--|
| Description | Set color sensor status |
| Parameter | Select color sensor: • Right • Left Status: • ON |
| | • OFF |
| Return | None |

Table 5.79 Get RGB value

| Instruction | retrun Right - Color Senor Red - Data |
|-------------|---|
| 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 | Detected Right - Color Senor Red - Data |
|-------------|--|
| Description | Detect whether the color sensor detects color data |
| Parameter | Select color sensor: |
| | • Right |
| | • Left |

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

Table 5.81Get the switch status

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

Table 5.82Get the motor angle

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

Table 5.83 Set the ultrasonic sensor detection threshold

| Instruction | Set Sonar Threshold 1 |
|-------------|---|
| Description | Set the detection threshold of ultrasonic sensor |
| Parameter | Threshold: Set the detection threshold, value range: 0 - 51.2cm |
| Return | None |

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Table 5.84 Set position offset

| Instruction | Set Deviation IR1x 0 +IR2x 0 +IR3x 0 +IR4x 0 +IR5x 0 +IR6x 0 |
|-------------|--|
| 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 | Get Deciation |
|-------------|--------------------------------|
| Description | Get the infrared sensor offset |
| Parameter | None |
| Return | Return offset |

Table 5.86 Get the infrared sensor offset after PID processing

| Instruction | Get PID-Processed Deviation |
|-------------|---|
| Description | Get the infrared sensor offset after PID processing |
| Parameter | None |
| Return | Return offset |

Table 5.87 Se PID parameters



| Instruction | Set Line Follower PID KP 0 KI 0 KD 0 Accumulated Error Limit 0 |
|-------------|--|
| 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

| Instruction | Set port 13 mode OUTPUT - |
|-------------|---------------------------|
| Description | Set port mode |
| Parameter | port: Port index |
| | Select mode: |
| | • OUTPUT |
| | • INPUT |
| | • INPUI_PULLUP |
| Return | None |

Table 5.88 Set pin mode

Table 5.89 Set baud rate for serial data transmission

| Instruction | Set baud rate 115200 |
|-------------|--|
| Description | Set baud rate for serial data transmission |
| Parameter | Baud rate: Set the baud rate for data transmission |
| Return | None |

Table 5.90Set baud rate for Xbee data transmission

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|---------------------------|------------|--|
|---------------------------|------------|--|



| Instruction | Set XBee baud rate 115200 |
|-------------|---|
| 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 | Serial Printin "hello world" |
|-------------|------------------------------|
| Description | Serial print |
| Parameter | Set data to be printed |
| Return | None |

Table 5.92 Serial line feed

| Instruction | Serial Print "hello world" |
|-------------|----------------------------|
| Description | Serial line feed |
| Parameter | Set data to be printed |
| Return | None |

Table 5.93 Get serial value

| Instruction | Get Serial value |
|-------------|---------------------------|
| Description | Get data from serial port |
| Parameter | None |
| Return | Data byte |

Table 5.94 Get serial string

| Instruction | Get Serial string | | |
|--------------|-------------------|------------|--|
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| Description | Get string from serial port |
|-------------|-----------------------------|
| Parameter | None |
| Return | String |

5.5.2 **IO Operation**



| Instruction | Arduino digital port 13 level HIGH - |
|-------------|--------------------------------------|
| Description | Set Arduino digital level |
| Parameter | port: Digital port |
| | level: HIGH or LOW |
| Return | None |

Table 5.96 Set analog pin value

| Instruction | Output analog port 5 duty cycle 5 |
|-------------|---|
| 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 | Get digital port 5 |
|-------------|-------------------------|
| Description | Read digital port value |
| Parameter | port: Digital port |
| Return | True: Read successfully |
| | False: Read failed |

Table 5.98 Read digital port value



| Instruction | Get digital port 5 |
|-------------|-------------------------------|
| Description | Read digital signal pin value |
| Parameter | port: Digital port |
| Return | 0: Low level |
| | 1: High level |

Table 5.99Read analog port value

| Instruction | Analog Read port 5 |
|-------------|------------------------|
| 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 | Set soundwave port 5 output frequency 5 output time 5 |
|-------------|---|
| 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 |



| Instruction | Set servo port 5 angle 5 |
|-------------|---|
| 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

to complete the initialization according to the tips. The initialization steps are as

follows.

Step 1 Follow the prompts to complete the initialization.

| | • • • • • • • | Close 🗙 |
|---------------|--|---------|
| | Visual Sorting Initialization | |
| | includes Coordinate Calibration and Color e the Initialization please make sure. | (|
| 2. Magician h | o Skill Kit has already been installed on Mag as already been connected to local compute as already been installed on local computer | |

Figure 5.14 Vision sorting initialization

MNOTICE

Please download and install PixyMon according to different PC systems.

| PIXY | = |
|---|-------------------------------|
| Pixy2 Downloads | |
| | |
| | xy2. These downloads will not |
| This page contains links to the most recent software/firmware releases for Pi work with the original Pixy! PixyMon v2 | xy2. These downloads will not |
| | |
| work with the original Pixyt PixyMon v2 PixyMon v2 that runs on Windows. MacOs PixyMon v2 Windows version 3.0.24 (exe) | |
| work with the original Pixy! PixyMon v2 PixyMon v2 is the configuration utility for Pixy2 that runs on Windows. MacOS | |

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".

| | Init Visual Sorting | | Close 🗙 |
|---|---------------------|---|---------|
| | | Visual Sorting Initialization | |
| | Step 2: Set D | ifferent Color Blocks' Height | |
| 9 | recognition.Block | erent color blocks' height. The program supports fou s with the same color should be with the same heig al Sorting operation. | |
| | Red | mm <mark>Y</mark> ellow m | ım |
| | Blue | mm Green m | ım |
| | | 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**.

| ١ | /isual Sorting | Initialization | |
|--|---|--|---|
| p 3: Record Vi | sual Rocogniti | on Location | |
| e specific location e two methods belo et between the To ation.After recordir | every time after th w to record the vis ol Center Point of ng the location. | e initialization. Please sual recognition locatio the Magician and the | choose one of on. There is an camera |
| Method | 11 | Method2 | |
| cord Magician's C | urrent Location | X Y | Z |
| XY | Z | Input Magician's | Location |
| Reco | ď | Record | |
| | ep 3: Record Vi e current Visual So e specific location e two methods belo et between the To ation.After recordir ase don't move the Method ecord Magician's C X Y | e current Visual Sorting Program car e specific location every time after th two methods below to record the vis et between the Tool Center Point of ation.After recording the location. ase don't move the robotic arm b Method1 ecord Magician's Current Location | ase don't move the robotic arm before the initialization Method1 Method2 ecord Magician's Current Location X Y X Y Z Input Magician's |

Figure 5.18 Record recognition position

Step 5Record values of the PixyMon calibration point. Follow the prompts to place theIssue V1.5.0 (2020-07-22)User GuideCopyright © Yuejiang Technology Co., Ltd



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

MNOTICE

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

| | Visu | al Sorting | Initialization | P |
|----------------|----------------|---------------|----------------|-----------------------------------|
| Step 5: Re | cord Marke | d Blocks's | Robotic Arm | Coordinates |
| ren - overanne | | | ocks.Please ma | ike sure the locks'sequence in |
| step 4. | ino pointo yot | rocord is the | , sams as mo o | locks sequence in |
| | X | Y | | Record |
| step 4. | | | | |

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



| Instruction | Speech Recognition Init |
|-------------|--------------------------------------|
| Description | Initialize speech recognition module |
| Parameter | None |
| Return | None |

Table 5.103 Add speech

| Instruction | Add Speech Recognition " hello " to Phrase 1 - |
|-------------|--|
| 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 | Detect Phrases 1 - |
|-------------|----------------------------------|
| Description | Detect voice module |
| Parameter | Select speech recognition number |

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| Return | True: Voice detected |
|--------|---------------------------|
| | False: No speech detected |

5.5.5 JoyStick



| Instruction | Check Red - Button State |
|-------------|---|
| Description | Get button status |
| Parameter | Select button: • Red • Green • Blue |
| Return | Status: • true: Up • false: Down |

Table 5.106 Set LED status

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

Table 5.107 Get LED status

| Instruction | Check Red - | LED State | |
|---------------------------|------------------|------------|--|
| Description | Check LED status | | |
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| Parameter | Select LED |
|-----------|------------|
| | • Red |
| | • Green |
| | • Blue |
| Return | True: ON |
| | False: OFF |

Table 5.108 Read Joystick value

| Instruction | Read Joystick x - Value |
|-------------|-------------------------|
| Description | Read Joystick value |
| Parameter | Joystick coordinate |
| | • x |
| | • y |
| Return | Joystick value |

Table 5.109 Check Joystick status

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

5.6 AlStarter

5.6.1 AlStarter

| Instruction | Smartbot Init | | |
|---------------------------|-----------------------|------------|--|
| Description | Initialize AI-Starter | | |
| Parameter | None | | |
| Return | None | | |
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Table 5.111 Initialize switch

| Instruction | Set Key Init |
|-------------|-------------------|
| Description | Initialize switch |
| Parameter | None |
| Return | None |

Table 5.112 Set LED status

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

Table 5.113 Set PID

| Instruction | Set Motor PID KP 1 KI 1 | |
|-------------|---|--|
| 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

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| Instruction | Car Right - Motor Speed 1 RPM |
|-------------|--|
| Description | Set motor speed |
| Parameter | Select the motor |
| | • LEFT |
| | • RIGHT |
| | Speed: Set the motor speed. Value range: 0r/m - 100r/m |
| Return | None |



| Instruction | Attach Servo SERVO1 - |
|-------------|--|
| Description | Turn on tipper-hopper mode. Namely, the car upload objects |
| Parameter | Select servo |
| Return | None |



| Instruction | Detach Servo SERVO1 - |
|-------------|-----------------------------|
| Description | Turn off tipper-hopper mode |
| Parameter | Select servo |
| Return | None |

Table 5.117 Set servo angle

| Instruction | Set Servo SERVO1 - Angle 1 |
|-------------|--|
| Description | Set servo angle |
| Parameter | Servo: Select motor Angle: Set angle |
| Return | None |
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5.6.3 Sensor

| Instruction | Star RightFront - Sonar |
|-------------|-------------------------|
| Description | Start ultrasonic sensor |
| Parameter | Sensor: |
| | Right front |
| | • Front |
| | Left front |
| Return | None |

Table 5.119 Detect obstacle

| Instruction | RightFront Barriers Detected |
|-------------|--|
| 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 | Return RightFront - Sonar Data |
|-------------|--|
| Description | Get the distance between AI-Starter and barrier. |
| Parameter | Sensor: • Right front • Front • Left front |
| Return | Detection distance |

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| Table 5.121 Get infrared s | sensor data |
|----------------------------|-------------|
|----------------------------|-------------|

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

Table 5.122Get geomagnetic angle

| Instruction | Return geomagnetic Angle |
|-------------|--------------------------|
| Description | Get geomagnetic angle |
| Parameter | None |
| Return | Geomagnetic angle |

Table 5.123 Set calibration

| Instruction | Set Calibration |
|-------------|--|
| 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 | Set Right - Color Senor White Balance | |
|-------------|---------------------------------------|--|
| Description | Set white balance of the color sensor | |
| Parameter | Color sensor: | |
| | • Right | |
| | • Left | |
| Return | None | |



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

Table 5.126 Detect RGB

| Instruction | Detected Right - Color Senor Red - Data |
|-------------|--|
| Description | Get color sensor value |
| Parameter | Color sensor: • Right • Left Color: • Red • Green • Blue |
| Return | True: Detect successfully |

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False: Detect failed

Table 5.127 Get RGB

| Instruction | retrun Right - Color Senor Red - Data | |
|-------------|--|--|
| 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 | Return Button Switch1 - Data |
|-------------|--|
| Description | Get switch status |
| Parameter | Switch: • Switch 1 • Switch 2 • Switch 3 |
| Return | true: Press false: Release |

Table 5.129 Get photosensitive value

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

Table 5.130 Set ultrasonic sensor threshold

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|---------------------------|------------|--|
| | <i>c</i> 1 | |



| Instruction | Set Sonar Threshold Distance |
|-------------|--|
| Description | Set ultrasonic sensor threshold |
| Parameter | Ultrasonic sensor threshold. Value range: 0~51.2cm |
| Return | None |

Table 5.131Set the position offset

| Instruction | Set Deviation IR1× 0 +IR2× 0 +IR3× 0 +IR4× 0 +IR5× 0 +IR6× 0 | |
|-------------|--|--|
| 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 | Get Deciation |
|-------------|---|
| 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 | Get PID-Processed Deviation | | |
|--------------------------------------|---|------------|--|
| Description | Get the infrared sensor offset after PID processing | | |
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| Parameter | None |
|-----------|---------------|
| Return | Return offset |

| Table 5.134 | Get the infrared sensor offset |
|-------------|--------------------------------|
|-------------|--------------------------------|

| Instruction | Get Headstock Deciation |
|-------------|----------------------------------|
| Description | Get the infrared sensor offset a |
| Parameter | None |
| Return | Return offset |

Table 5.135 Get motor pose

| Instruction | Get Motor Pose Port Right - |
|-------------|---|
| 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 | Set Line Follower PID KP 0 KI 0 KD 0 Accumulated Error Limit 0 |
|-------------|--|
| 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 | Xbee read data |
|-------------|----------------|
| Description | Get Xbee value |
| Parameter | None |
| Return | Xbee value |

Table 5.138 Send Xbee value

| Instruction | Xbee Send "hello world" |
|-------------|---------------------------------|
| Description | Send Xbee values |
| Parameter | Value: Set the value to be sent |
| Return | None |

Table 5.139 Clear Xbee cache

| Instruction | Xbee Clear |
|-------------|----------------------|
| Description | Clear the Xbee cache |
| Parameter | None |
| Return | None |