Table of Contents

myCobot 280 pi(2023)

The world's smallest collaborative robot

Core Document

This document contains comprehensive information from product introduction, detailed technical parameters to user instructions and product development guidance. The document will introduce the basic functions of the myCobot 280 pi robot arm in depth, provide software development guidelines, and show successful application cases to help you understand how to effectively integrate myCobot 280 pi into various applications. In addition, we also provide a wealth of support and service information to ensure that you can get the necessary help when you encounter any technical challenges.

Document Description

Depending on your needs and your level of expertise in myCobot 280 pi application development, you can choose to read it from beginning to end in this order or use it as a standalone reference. You can use the left sidebar navigation to jump to any part of this document at any time. The full text is divided into the following five sections:

Product Information

The Product Information section will provide you with a basic overview of the robot arm, including detailed technical specifications such as main functions, product parameters and electrical characteristics, to help you quickly understand the basic characteristics and usage environment of the product. In addition, this section will detail the application examples and supported extension development of the product, providing you with the necessary development guides and resources. At the end of the article, relevant purchase links and channels will be provided for your convenience.

Basic Settings

This section is an important section that every user of this product must read carefully. It covers key information about product use, transportation, storage and maintenance, aiming to ensure the safety and efficiency of users when operating the product. In addition, this section also details the division of responsibilities for product failure or damage that may occur due to failure to follow these guidelines.

Functions and Applications

The Functions and Applications section details the basic functions of the robot arm and how to use the software, including system instructions and firmware functions. The Software Development Guide provides guidance based on different development environments, such as Python and ROS, to support technical developers to expand applications. By showcasing successful application cases and providing supporting resources, we provide you with practical references and necessary support materials for a deeper understanding and use of the product.

Support & Services

The Support & Services section will provide you with comprehensive troubleshooting guides and post-purchase service information, such as warranty and service terms, to help you quickly resolve problems when you encounter them and ensure that you understand your rights and obligations after purchase. In addition, the 'About Us' section

strengthens users' understanding of the design and manufacturer of the myCobot series products, aiming to build trust and brand loyalty.

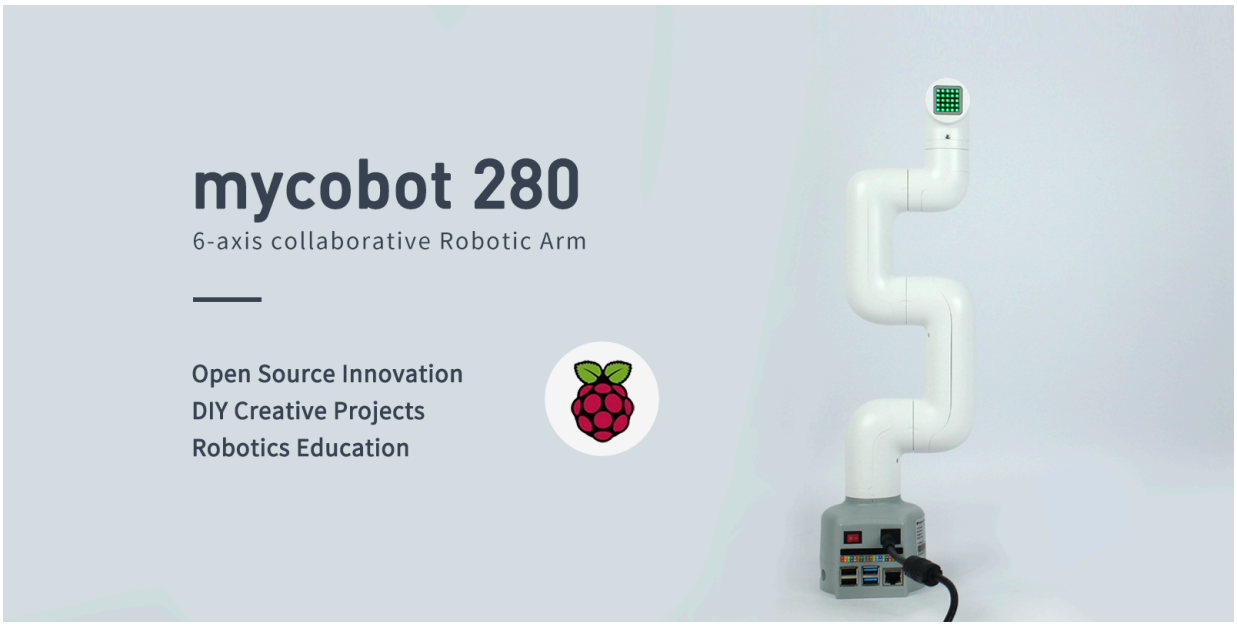
Acknowledgements

We appreciate your time reading the myCobot 280 pi User Manual. We hope that this document will help you better understand and effectively use this robot, thereby inspiring your creativity. If you have any questions or need further assistance, please feel free to contact our customer support team. We look forward to seeing your innovative projects with myCobot 280 pi and welcome you to join our rapidly growing developer community.

Document Directory

Product Overview

myCobot 280 pi



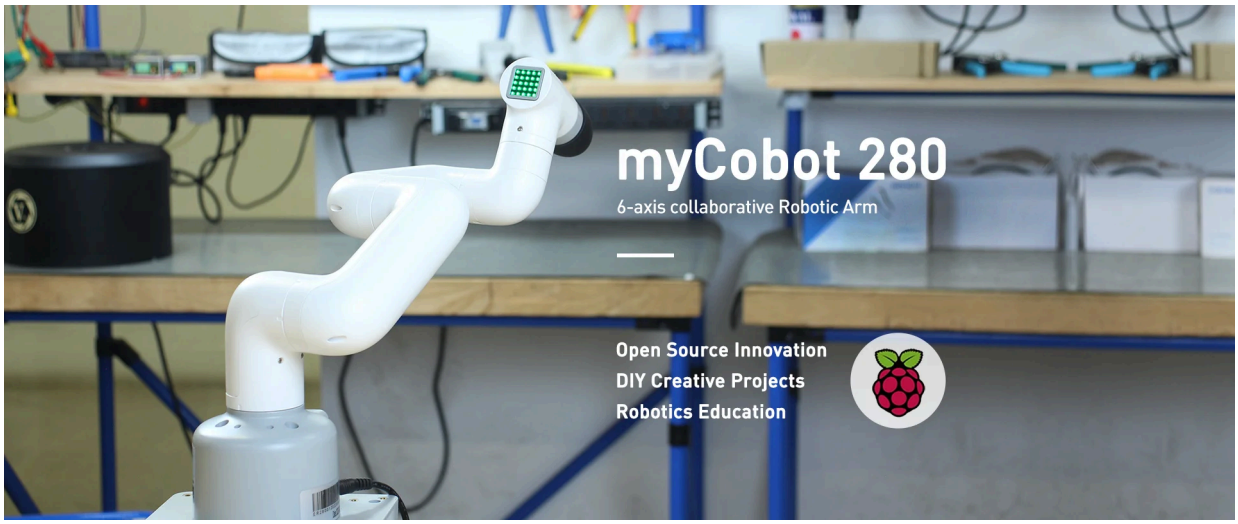
Desktop-level six-axis collaborative robot

1.Product Introduction

The myCobot 280 Pi six-axis collaborative robot is a **multi-functional lightweight intelligent robotic arm** carefully developed by Elephant Robotics. It belongs to the "myCobot series" products and uses **Raspberry Pi microprocessors**. It is one of the core products of Elephant Robotics for **robots and artificial intelligence education ecosystems**.

The myCobot 280 Pi six-axis collaborative robot weighs **860g**, has a payload of **250g**, and an arm span of **280mm**. It is compact but powerful, has a rich software and hardware interaction mode and a variety of compatible expansion interfaces, supports secondary development on multiple platforms, and meets the needs of scientific research, education, smart home, commercial exploration, etc.

Design concept

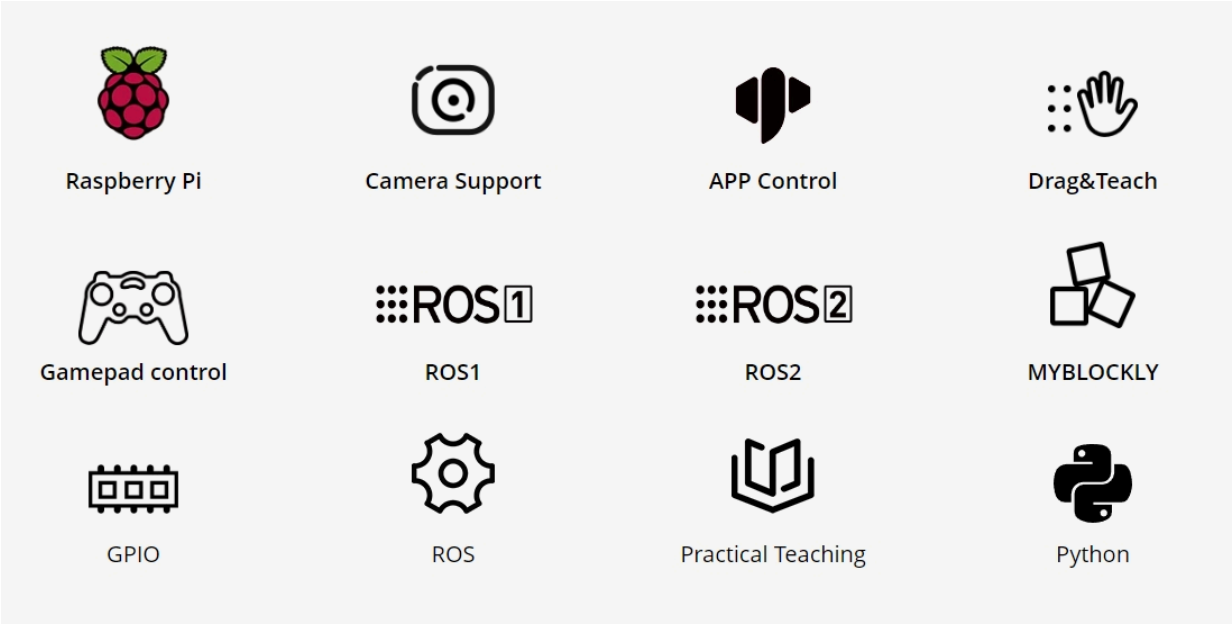


The myCobot 280 pi robotic arm is a six-degree-of-freedom collaborative robot developed by Elephant Robotics for scenarios such as scientific research and education, maker applications, and commercial displays. The appearance and structure of the robotic arm are compact and exquisite, with an integrated fully enclosed body design without any external cables. It is equipped with the robot motion control algorithm independently developed by Elephant Robotics, and supports multiple control modes such as angle, coordinate, potential value, and radian value, which makes it easier for users to understand the complex working principles of robots and the application principles of robots. It uses a Raspberry Pi microprocessor and has a built-in Ubuntu Mate 20.04 operating system. It does not require a PC master control and can be used by connecting a monitor, keyboard, and mouse. It is the preferred assistant for quickly building robotic arm programming education, control logic development, robot applications, and ROS simulation experiment classrooms, helping users quickly start learning and applying six-axis robotic arms.

Design goals

Design goals	Description	Application scenarios and features
General multi-functional platform	myCobot 280 pi is suitable for a variety of application scenarios such as education, research and commercial display, maker development, etc.	Its six degrees of freedom and 280mm arm span support complex motion control in various working environments. It can be equipped with a variety of end accessories such as grippers and suction pumps to meet various scene applications.
Education support	myCobot 280 pi supports drag-and-drop programming language, interactive drag teaching with buttons, and intuitive display of the working mode of the robotic arm.	The product supports the myblocky graphical programming tool. Programming by dragging and combining different modules helps beginners to intuitively experience the application of robots.
Programmability and scalability	The high programmability of myCobot 280 pi allows users to customize and program according to emerging technologies to adapt to the needs of future technologies.	Through user-defined programming, the device can achieve optimized operation and experimental results to meet the ever-changing research and development.
Technology innovation and knowledge dissemination	myCobot 280 pi can be used as a platform to showcase the latest scientific and technological achievements in commercial exhibitions, aiming to enhance the public's understanding and interest in science and technology, and promote the transformation of scientific and technological innovation into commercialization.	By displaying and demonstrating the latest scientific and technological achievements, increase public participation, promote the popularization of scientific and technological knowledge and the market acceptance of scientific and technological products.

Product Features



Built-in Ubuntu Mate 20.04 operating system, specially developed for robots	AP hotspot is enabled by default, and it is easy to control by connecting to the AP network. Built-in a variety of development software, such as myStudio, myBlockly, etc. Built-in a variety of development environments, such as: ROS, Python, etc. Built-in a large number of extended applications, supporting visual development, front-end interface development, etc. Open the underlying operating permissions of the system to support user customized development.
Embedded Raspberry Pi ecosystem, unlimited development possibilities	Raspberry Pi 4B, 1.5GHz 4-core microprocessor, built-in Linux platform Ubuntu Mate 20.04 operating system. Supports 4 USB, 2 HDMI, standardized Raspberry Pi 4B-GPIO interface, TF card pluggable.
Supports ROS1+ROS2 and graphical programming	Supports ROS1+ROS2 multi-version applications, so that development is no longer restricted. Supports graphical programming software, making robot programming applications within reach.
Image recognition, rich accessories, and wide application	Comes with image recognition algorithm, and can be equipped with any camera. Independently match different accessories such as display, gripper suction pump, etc. to achieve more application scenarios. Supports the expansion of artificial intelligence kits for robot education and teaching.
Unique industrial design, extremely compact	Integrated design, the overall body structure is compact, the net weight is only 860g, and it is very easy to carry. Modular design, few spare parts, low maintenance cost, can be quickly disassembled and replaced, and plug-and-play is realized.

High-configuration joint module, support LEGO interface	Contains 6 high-performance servo motors, fast response, small inertia, and smooth rotation. The base and the end are equipped with LEGO technology parts interface, which is suitable for the development of various micro embedded devices.

2.Product Application

User Group

Educational Institutions	myCobot 280 pi can be used as a teaching and research tool designed for robot experiments and technical demonstrations. It does not need to be paired with a PC master control, and can be used by connecting a monitor, keyboard, and mouse. It provides image drag-and-drop programming software specifically for entry-level teaching, making it easy to understand the principles of the robotic arm.
Technical Developers and Engineers	Built-in Ubuntu Mate 20.04 operating system. Supports Raspberry Pi native hardware interfaces, dozens of official actuators, and the terminal Lego interface can be connected to various sensors to achieve color recognition and tracking, QR code and gesture recognition, voice broadcast and other functions.
Commercial Display and Public Exhibition Organizers	myCobot 280 pi has become the preferred device for technology display and product demonstration with its precision operation display advantages. Dynamic demonstrations not only attract audiences, but also enhance their sense of participation, effectively promoting technological innovation and products.
Geek development enthusiasts	myCobot 280 pi is based on the Raspberry Pi 4B motherboard and supports the Arduino + ROS open source system. Dozens of accessories such as adaptive grippers, camera flanges, suction pumps, etc. help you give full play to myCobot's creative ideas to meet the various creative ideas of enthusiasts.

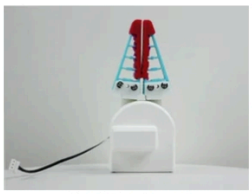
3.Application scenarios

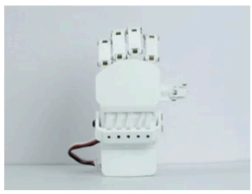
Applicable groups	Application scenarios	Advantage targets
Teachers and students in the field of education	- STEM education	- Improve students' interest in science and technology
	- Robotics projects	- Enhance hands-on skills and problem-solving skills
	- Interdisciplinary research projects	- Promote innovative thinking and teamwork
	- Education and research	- Provide a practical platform for data collection and robotics
Makers and technical developers	- Prototype development	- Rich accessories
	- Experimental research	- Connect theory and practice
	- Robot trial teaching	- Promote technological innovation
Business presentations and marketing professionals	- Exhibitions	- Attract potential customers and investors
	- Technology demonstrations	- Show the company's technical strength and innovative products
	- Brand promotion	- Enhance brand influence

Supported extended development


Adaptive gripper


Parallel gripper


Flexible gripper


Dexterous hand


Vertical suction pump

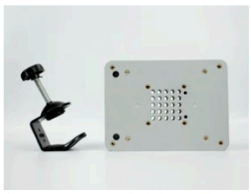

Dual vacuum gripper


Pen holder


Mobile phone holder


Camera module


Cylindrical flange


G base


Flat base

The mycobot series of robotic arms are extremely valuable in the fields of education and scientific research, especially in Python and ROS (Robot Operating System), two widely used development environments. These environments provide strong support, allowing the mycobot series of products to be widely used in machine learning, artificial intelligence research, complex motion control, and visual processing tasks. At the same time, with dozens of accessories such as adaptive grippers, camera flanges, suction pumps, etc., you can give full play to myCobot's creative ideas.

Python	The robot supports Python and has a complete Python API library. The robot's joint angles, coordinates, grippers, etc. can be controlled through Python.
ROS	Supports both ROS1 and ROS2 versions, and provides RVIZ simulation environment support. Allows users to display the robot arm in real time and collect robot arm status information, making mycobot 280 pi suitable for ROS beginners and educational purposes.
Hardware interface	Including IO, USB, etc., convenient for connecting various sensors and actuators.
Software library	Provides a wealth of open source libraries andAPI to simplify the development process.
myBlockly	It is both a graphical programming software and a visualization tool. Users can drag and drop modules to create programs. This process is very similar to building blocks, which is convenient, fast and easy to use.

4.Where to buy

If you are interested in purchasing the device, please click on the link below: Taobao: https://shop504055678.taobao.com

Shopify: https://shop.elephantrobotics.com/

AliExpress: [https://elephantrobotics.aliexpress.com/store/1101941423]

(https://elephantrobotics.aliexpress.com/store/1101941423)

Next Chapter →

Robot Parameters

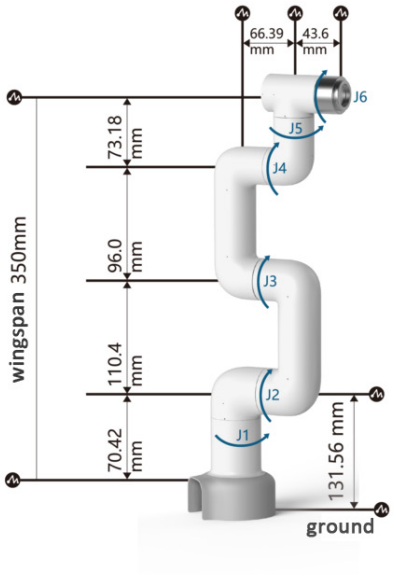
> In the first chapter, we discussed the selling points of the product and its design concept, providing you with a panoramic perspective of the high-level understanding of the product. Now, let's move on to the second chapter - Robot Parameters. This chapter will be the key to your understanding of the product's technical details. A detailed understanding of these technical parameters will not only help you fully realize the advancement and practicality of our products, but also ensure that you can use these technologies more effectively to meet your specific needs.

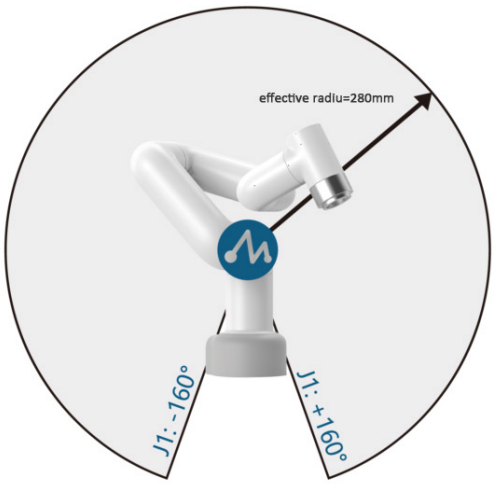
1. Structural parameters

1.1 Robotic arm parameters

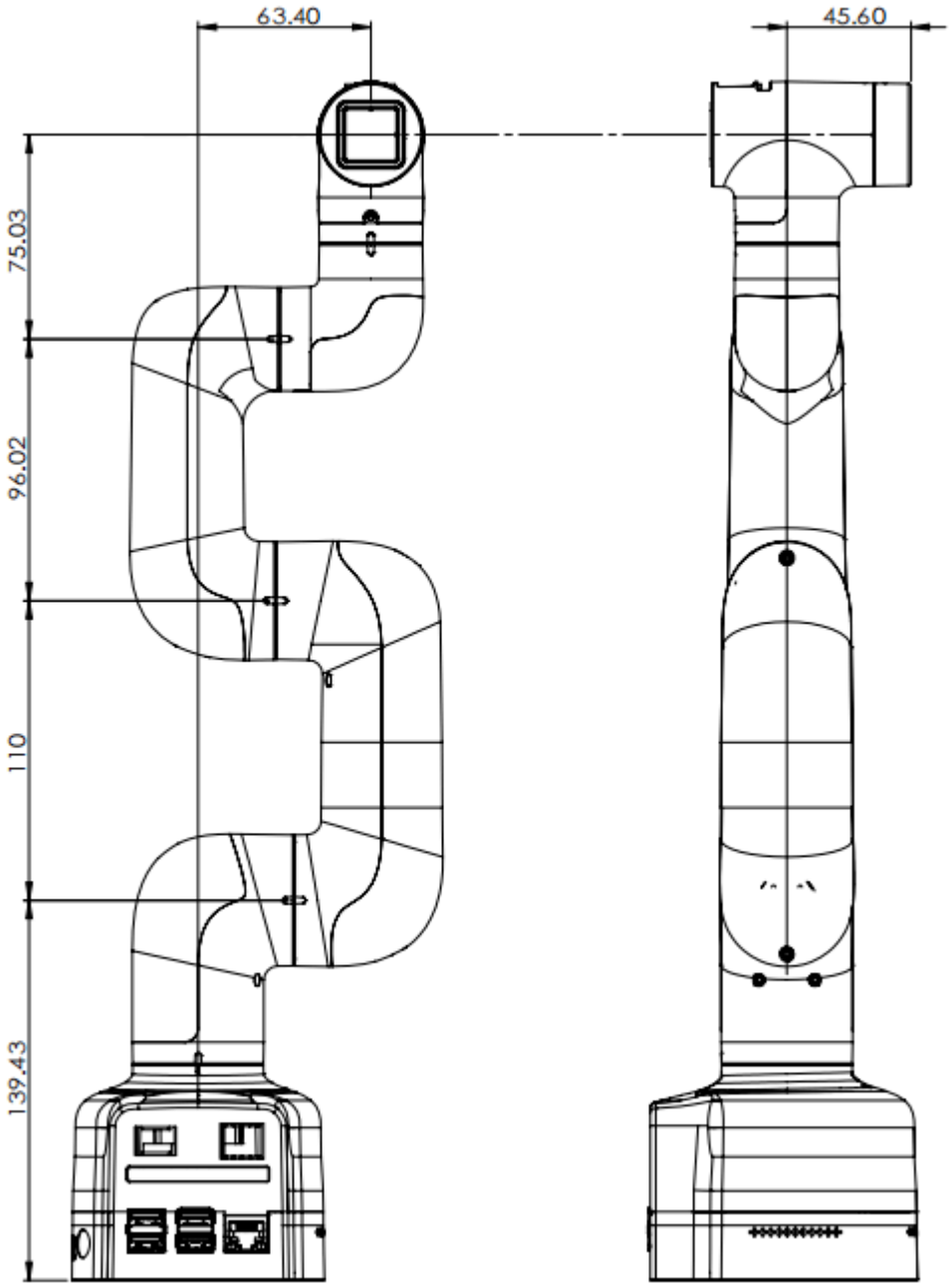
Index	Parameters
Name	Little Elephant Collaborative Robotic Arm
Model	myCobot 280 Raspberry Pi 2023
Degrees of freedom	6
Payload	250g
Working radius	280mm
Repeatability	±0.5mm
Weight	860g
Power input	12V, 5A
Working temperature	-5-45℃
Communication	Type-C

1.2 Workspace





1.3 Specifications and dimensions



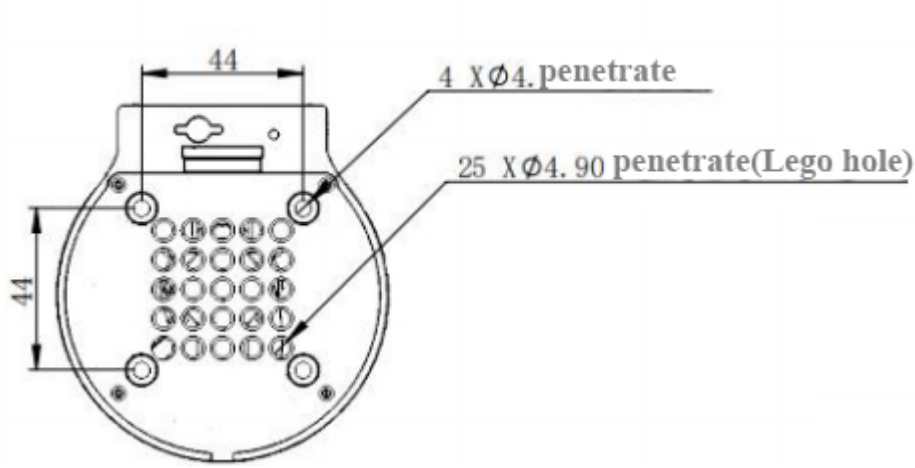
1.4 Joint range of motion

> **Note:** ⚠ This joint limit information function is only available on Atom firmware ≥ 7.3 and pymycobot library ≥ 4.0.2.

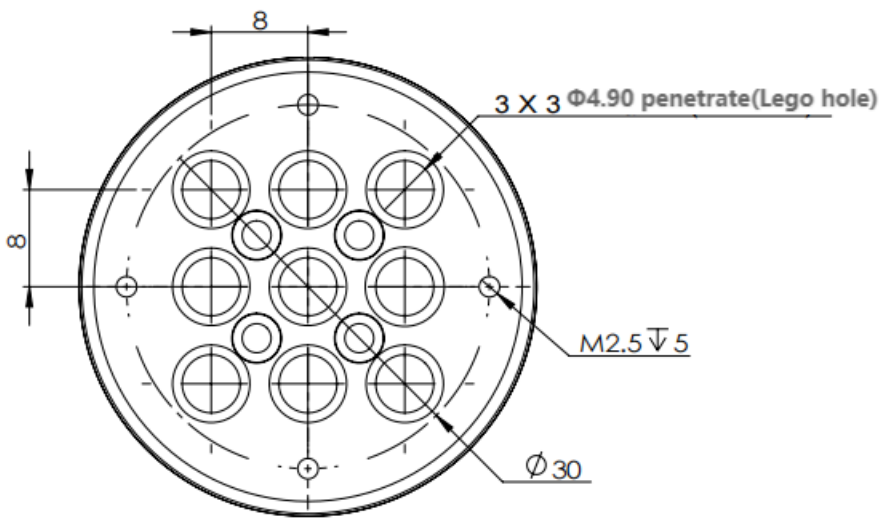
Joint	Range
J1	-168 ~ +168
J2	-140 ~ +140
J3	-150 ~ +150
J4	-150 ~ +150
J5	-155 ~ +160
J6	-180 ~ +180

1.5 Hole installation

- The robot base is mounted with flanges. The base is compatible with both LEGO technology and M4 screw installation.



- The end of the robot is equipped with a flange, and the end of the robot arm is compatible with both Lego technology holes and screw threaded holes.



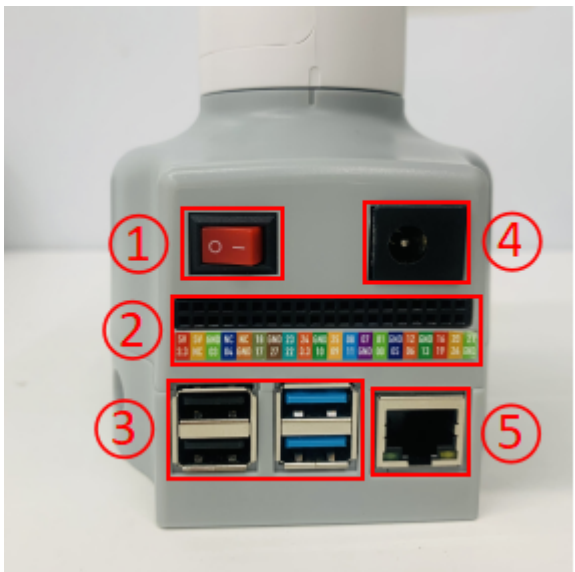
2.Electronic parameters

Indicators	Parameters
SOC	Broadcom BCM2711
CPU	64-bit 1.5GHz quad-core
Bluetooth/wireless	Yes
USB	USB3.0 x2; USB2.0 x2
Display screen	No
HDMI interface	microHDMI x2
Custom buttons	No
IO interface	40

3.Electrical characteristic parameters

3.1Electrical interface of the robotic arm base

Base introduction



- A. The front of the base is shown in the figure below:
- ① Switch button
- ② Function interface group 1
- ③ USB2.0, USB3.0
- ④ Power DC interface
- ⑤ Network port

- B. The side of the base is shown below: 

- ① SD card slot
- ② Type C
- ③ HDMI
- ④ Audio interface

3.2Base interface description

> **Note:** The function interface groups are all 2.54mm DuPont interfaces, and 2.54mm DuPont cables can be used externally.

- A. The definitions of each interface of functional interface group 1 are shown in the following table

Label	Signal name	Type	Function	Remarks
5V	5V	P	DC 5V	
5V	5V	P	DC 5V	
GND	GND	p	GND	
NC	NC	-	-	Not supported yet
NC	NC	-	-	Not supported yet
18	GPIO18	I/O	GPIO18	
GND	GND	p	GND	
23	GPIO23	I/O	GPIO23	
24	GPIO24	I/O	GPIO24	
GND	GND	p	GND	
05	GPIO5	I/O	GPIO5	
06	GPIO6	I/O	GPIO6	
13	GPIO13	I/O	GPIO13	
19	GPIO19	I/O	GPIO19	
26	GPIO26	I/O	GPIO26	
GND	GND	p	GND	

> **Note:**
>
> 1. I: Input only.
> 2. I/O: This function signal contains input and output combination.
> 3. When the tube corner is set as the output terminal, it will output a voltage of 3.3V.
> 4. The source current of a single tube corner decreases as the number of pins increases, from about 40mA to 29mA.
> 5. If a GPIO is set to output mode, it outputs a high-level signal, and the circuit connection is shown in Figure 2.1.5.2-3, and the LED light will light up.

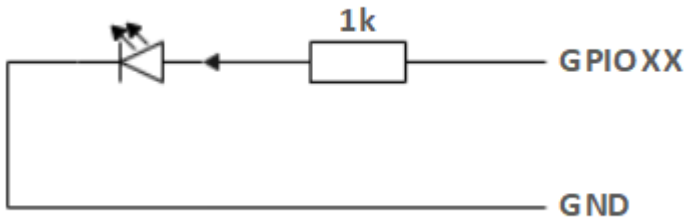


Figure 2.1.5.2-3

> 1. The other function tables of the function interface are shown in Figure 2.1.5.2-4. When other functions are used, the IO function is not available.

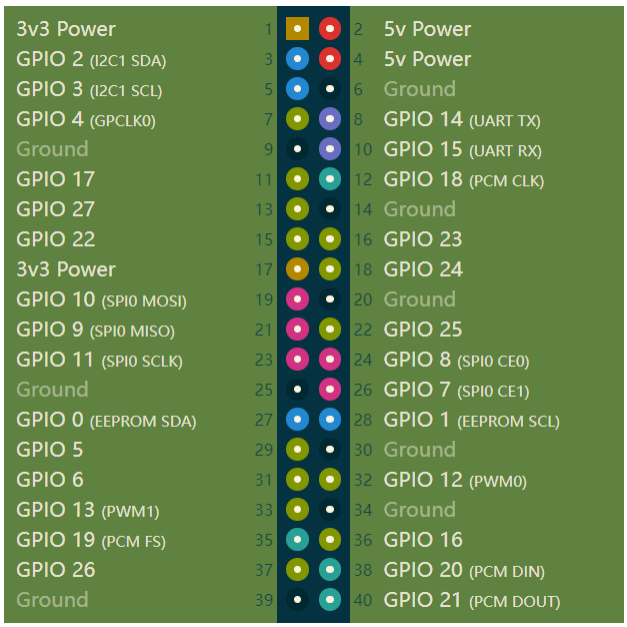


Figure 2.1.5.2-4

- B. Power DC interface: Use a DC power socket with an outer diameter of 6.5mm and an inner diameter of 2.0mm; the 12V 5A DC power adapter provided by the manufacturer can be used to power myCobot280.
- C. Switch button: Red is the switch, I is for power on, and O is for power off.
- D. USB2.0 interface: An interface that uses the serial bus standard 2.0 for data connection; users can use the USB interface to copy program files, or use the USB interface to connect peripherals such as a mouse and keyboard.

- E. USB3.0 interface (blue): An interface that uses the serial bus standard 3.0 for data connection; users can use the USB interface to copy program files, or use the USB interface to connect peripherals such as a mouse and keyboard.

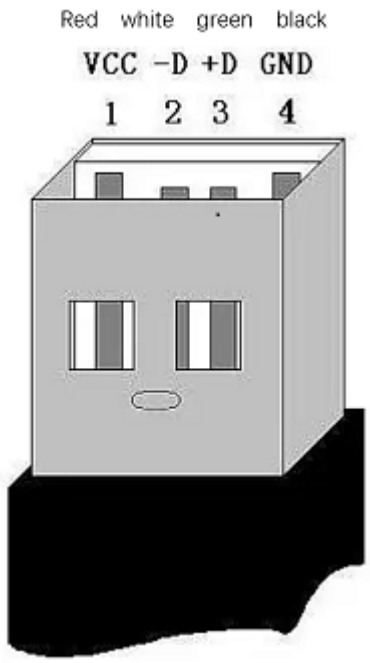


Figure 2.1.5.2-5

- F. Network port: The port for network data connection. Users can use the Ethernet interface for communication and interaction between the PC and the robot system, or for Ethernet communication with other devices.

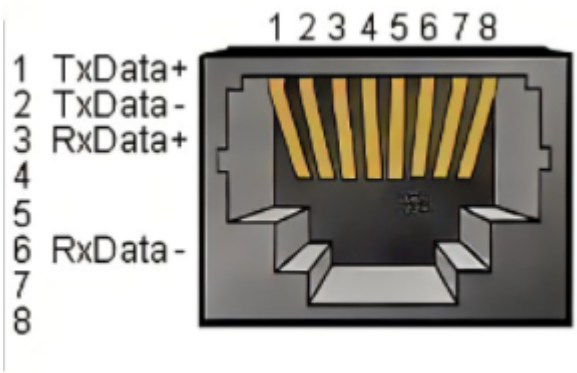


Figure 2.1.5.2-6

- G. HDMI interface: The interface is an HDMI D-type interface, which is used to connect to the display. HDMI interface 2 has priority, and HDMI interface 1 is recommended.
- H. Type C interface: The power supply port of the Raspberry Pi itself, which only powers the Raspberry Pi itself, and cannot power the entire machine. When all power DC interfaces can be used normally, there is no need to connect this interface.
- I. SD card slot: SD card can be inserted and removed. The size of the SD card is 32mm×24mmx2.1mm

4.Electrical interface of the end of the robot

Introduction to the end of the robot

- A. The end of the robot is shown in Figure 2.1.5.2-7 and Figure 2.1.5.2-8:

Figure 2.1.5.2-7 End of the robot

- ① Servo interface
- ② Atom

Figure 2.1.5.2-8 End of the robot

- ① Function interface group 2
- ② Grove
- ③ Type C

4.1Terminal Interface Description

- A. The definitions of each interface of Function Interface Group 2 are shown in the following table:

Label	Signal Name	Type	Function	ReserveNote
5V	5V	P	DC 5V	
GND	GND	P	GND	
3V3	3V3	P	DC 3.3V	
G22	G22	I/O	GPIO22	
G19	G19	I/O	GPIO19	
G23	G23	I/O	GPIO23	
G33	G33	I/O	GPIO33	

Note:

1. I: Input only.
2. I/O: This function signal contains input and output combination.
3. When the tube angle is set as output terminal, it will output voltage 3.3V.
4. The pull current of a single pin decreases as the number of pins increases, from about 40mA to 29mA.
5. If a GPIO is set to output mode, it outputs a high-level signal, and the circuit connection is shown in Figure 2.1.5.2-9, and the LED light will light up.

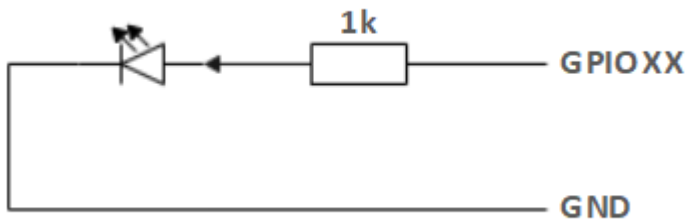


Figure 2.1.5.2-9

- B. Type C interface: can be used to connect and communicate with the PC and update the firmware.
- C. Grove: The definition is shown in Figure 2.1.5.2-10

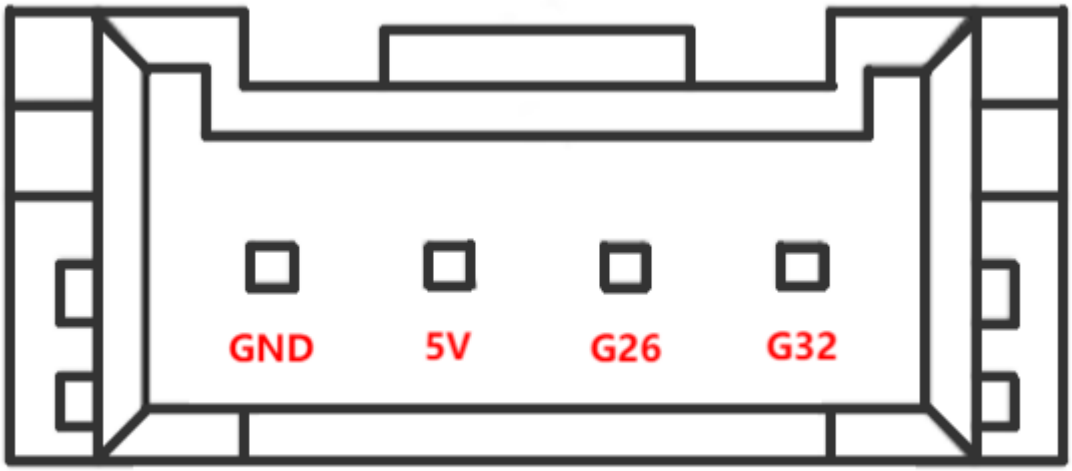
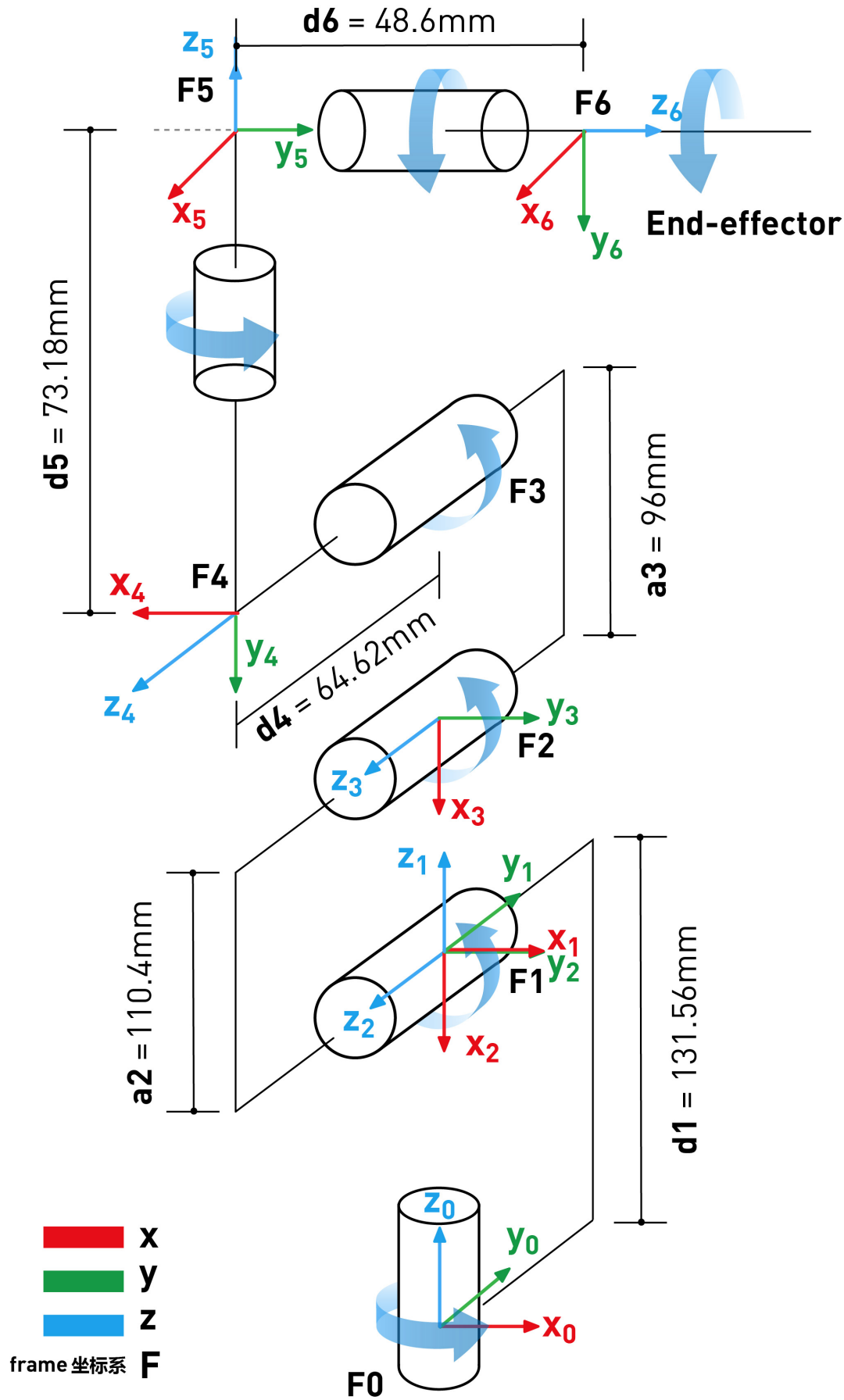


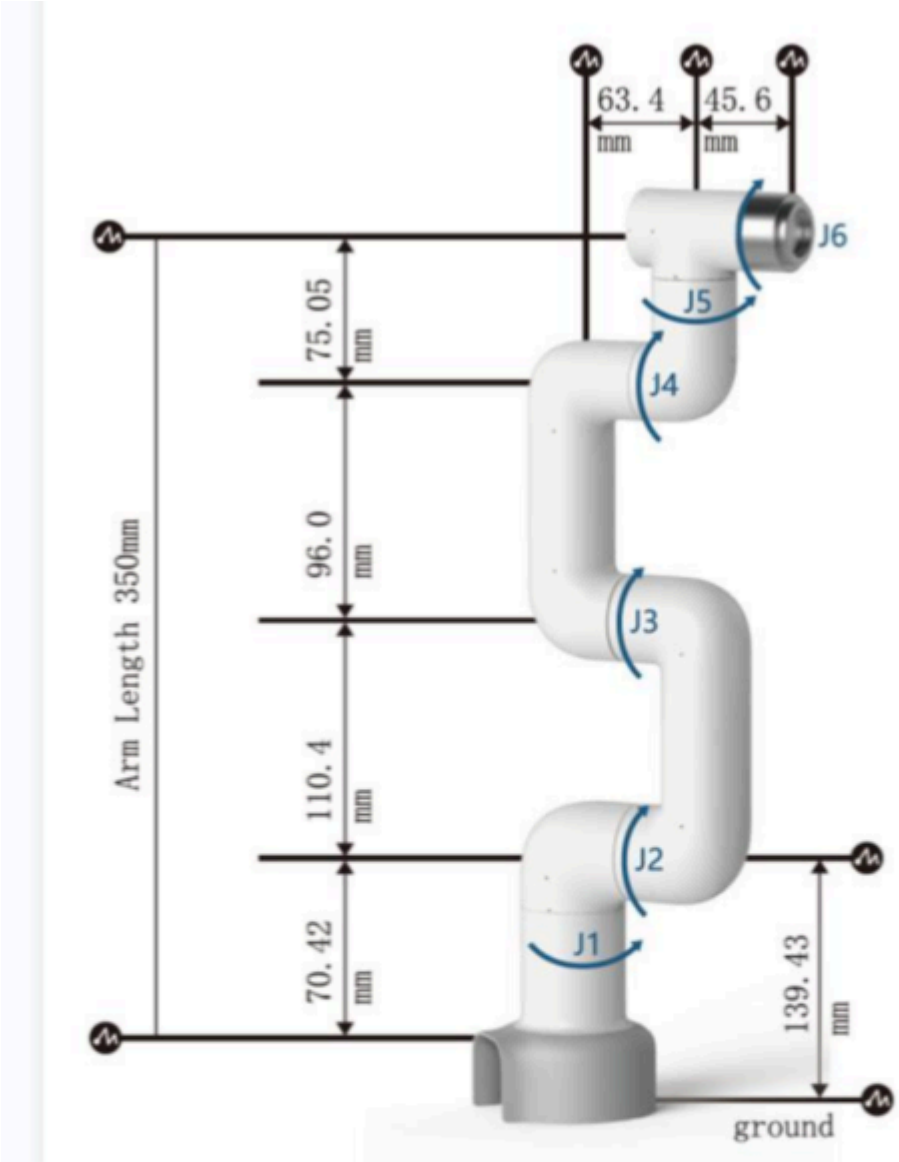
Figure 2.1.5.2-10 Grove

- D. Servo interface: used for the end extension gripper, currently supports the use of matching adaptive grippers.
- E. Atom: for 5X5 RGB LED (G27) display and key function (G39)

5.Cartesian coordinate parameters


d6 = 48.6mm
z5
F5
y5
x5
F6
z6
x6
y6
End-effector
d5 = 73.18mm
F3
a3 = 96mm
x4
F4
y4
z4
d4 = 64.62mm
y3
F2
z3
x3
z1
y1
x1
y2
F1
z2
x2
a2 = 110.4mm
d1 = 131.56mm
z0
y0
x0
F0
x
y
z
frame 坐标系 F

SDH parameters are shown in the figure below



ycobot280:: 6 axis, RRRRRR, stdDH, slowRNE

j	theta	d	a	alpha	offset
1	q1	139.43	0	1.5708	0
2	q2	0	-110.4	0	-1.5708
3	q3	0	-96	0	0
4	q4	63.4	0	1.5708	-1.5708
5	q5	75.05	0	-1.5708	1.5708
6	q6	45.6	0	0	0

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Chapter 3 User Notice

> Chapter 3 User Notice is a must-read for every user to ensure that the user can achieve the established safety standards and efficiency when using the product. This chapter not only provides basic information on product use, transportation, storage and maintenance to ensure safe operation and maximized efficiency of the product, but also details the liability issues for product failure or damage that may result from failure to comply with these guidelines.

1.Safety Instructions

Introduction

This chapter details general safety information for personnel who perform installation, maintenance and repair work on the Elephant Robot. Please fully read and understand the contents and precautions of this chapter before handling, installing and using it.

Hazard Identification

The safety of collaborative robots is based on the premise of correctly configuring and using the robots. Moreover, even if all safety instructions are followed, injuries or damage to the operator may still occur. Therefore, it is very important to understand the safety hazards of robot use, which is conducive to preventing them before they happen.

Tables 1-1 to 3 below are common safety hazards that may exist when using robots:

Table 1-1 Dangerous safety hazards


1 Personal injury or robot damage caused by incorrect operation during robot handling.
2 Failure to fix the robot as required, such as lack of screws or screws not tightened, insufficient base locking capacity to stably support the robot for high-speed movement, etc., causing the robot to fall over, resulting in personal injury or robot damage.
3 Failure to correctly configure the robot's safety functions, or insufficient installation of safety protection tools, etc., causing the robot's safety functions to fail to function, thus causing danger.

Table 1-2 Warning-level safety hazards


1 Do not stay in the robot's motion range when debugging the program. Improper safety configuration may not be able to avoid collisions that may cause personal injury.
2 The connection between the robot and other equipment may cause new hazards, and a comprehensive risk assessment needs to be re-performed.
3 Scratches and punctures caused by sharp surfaces such as other equipment or the robot's end effector in the working environment.
4 The robot is a precision machine and trampling may cause damage to the robot.
5 Failure to clamp in place or not removing the clamped object before turning off the robot's power or air source (not confirming whether the end effector is secure and the clamped object falls due to power loss) may cause dangers, such as damage to the end effector and injuries to people.
6 The robot may move unexpectedly. Do not stand under any axis of the robot under any circumstances!
7 The robot is a precision machine. If it is not placed stably during transportation, it may cause vibration, which may cause damage to the robot's internal components.
8 Compared with ordinary mechanical equipment, the robot has more degrees of freedom and a larger range of motion. Failure to meet the range of motion may cause unexpected collisions.

Table 1-3 Safety hazards that may cause electric shock


1 Using non-original cables may cause unknown dangers.
2 Electrical equipment in contact with liquid may cause leakage.
3 There may be a risk of electric shock when the electrical connection is incorrect.
4 Always turn off the power of the controller and related devices and unplug the power plug before replacing. If the work is carried out in the power-on state, it may cause electric shock or malfunction.

2.Safety Precautions

The following safety rules should be followed when using the robot arm:

- The robot arm is a live device. Non-professionals are not allowed to change the circuit at will, otherwise it is easy to cause damage to the equipment or personal injury.

- When operating the robot arm, local laws and regulations should be strictly observed. The safety precautions and "Danger", "Warning" and "Caution" items described in the manual are only used as supplements to local safety regulations.
- Please use the robot arm within the specified environmental range. Exceeding the robot arm specifications and load conditions will shorten the product life or even damage the equipment.
- Personnel responsible for installing, operating and maintaining the myCobot robot arm must first undergo rigorous training, understand various safety precautions, and master the correct operation and maintenance methods before operating and maintaining the robot.
- Do not use this product in a humid environment for a long time. This product is a precision electronic component. Long-term operation in a humid environment will damage the device.
- Do not use this device in a high temperature environment. The outer surface of this device is made of photosensitive resin as raw material. Higher temperatures will damage the outer shell of the device and cause equipment failure.
- Highly corrosive cleaning is not suitable for cleaning the robot arm, and anodized parts are not suitable for immersion cleaning.
- Do not use this product without a base installed to avoid damage to the device or accidents. This product should be used in a fixed environment with no obstacles around.
- Do not use other power adapters for power supply. If the device is damaged due to the use of an adapter that does not meet the standards, it will not be covered by after-sales service.
- Do not disassemble, disassemble, or unscrew the screws or casing of the robot arm. If disassembled, warranty service cannot be provided.
- Personnel who have not received professional training are not allowed to repair faulty products or disassemble the robot arm without authorization. If the product fails, please contact myCobot technical support engineers in time.
- If the product is scrapped, please comply with relevant laws to properly dispose of industrial waste and protect the environment.
- Children must be monitored by someone during use, and the device must be turned off in time when the operation is completed.
- When the robot is in motion, do not put your hand into the range of motion of the robot arm to avoid injury.
- It is strictly forbidden to change or remove and modify the nameplate, instructions, icons and markings of the robot arm and related equipment.
- Please be careful during transportation and installation. Please place the robot gently and correctly in the direction of the arrow according to the instructions on the packaging box, otherwise it is easy to damage the machine.
- **Do not burn other product drivers without authorization, or use unofficial recommended methods to burn firmware.** If the device is damaged due to the user's personal burning of other firmware, it will not be covered by after-sales service.

If you have any questions or suggestions about the contents of this manual, please log in to the official website of Elephant Robotics to submit relevant information:

https://www.elephantrobotics.com

Do not use the robot arm for the following purposes:

- Medical and life-critical applications.
- In an environment that may cause an explosion.
- Direct use without risk assessment.
- Use with insufficient safety function level.
- Use that does not meet the robot performance parameters.

3.Transportation and storage

Packing and packaging

When packing and packaging the robot product, please make sure to use packaging materials and boxes designed for it. These materials can provide sufficient cushioning and support to prevent impact and vibration during transportation. Be sure to check that all parts are properly fixed to avoid looseness and damage. For fragile or sensitive parts, additional anti-vibration protection materials should be used for reinforcement. Finally, make sure that the outside of the packaging box is marked with clear handling and warning labels to indicate the correct handling method and storage direction.

Logistics and Transportation

During transportation, the robot product should be transported in the original packaging. During transportation, it should be ensured that the robot product is stable as a whole in the packaging box and protected by appropriate measures. During transportation and long-term storage, the ambient temperature should be maintained in the range of -20 to +55°C, and the humidity should be ≤95% without condensation.

Because the robot is a precision machine, the robot product should be handled with care when it is removed from the packaging. During transportation, if it is not placed stably, it may cause vibration and damage the internal parts of the robot.

Equipment Storage

After transportation, the original packaging should be properly stored in a dry place, the ambient temperature should be kept within the range of -20 to +55°C, the humidity should be ≤95% and there should be no condensation, in preparation for future repackaging and transportation needs. Do not stack other items on the original packaging box of the robot arm to prevent deformation of the packaging box and damage to the robot arm.

4.Maintenance and Care

As a robot manufacturer, we value ensuring that our customers can properly and safely maintain and upgrade their robot equipment. To this end, we provide the following detailed maintenance and care guide, including common maintenance items and parts for repairing or upgrading hardware. Please read carefully:

Common maintenance items and recommended cycles

Maintenance items	Description	Recommended cycle
Visual inspection	Inspect the robot for obvious damage, foreign material accumulation or wear.	Daily
Structural cleaning	Clean the robot structural parts with a clean, dry cloth. Avoid moisture and aggressive cleaning agents.	Daily
Fastener inspection	Inspect and tighten all bolts and connectors.	Daily
Lubrication	Lubricate joints and moving parts with the lubricant recommended by the manufacturer.	Every 3 months
Cable and wiring inspection	Inspect the cables and wiring to ensure that there is no damage or wear.	Monthly
Electrical connection check	Ensure that all electrical connections are secure and free of corrosion or damage.	Monthly
Software update	Check and update the control software and application.	Every update
Software data backup	Regularly back up key software configuration and data.	Quarterly
Firmware update	Regularly check and update the firmware to obtain the latest features and security patches.	Every update
Sensor and device check	Check sensors and other key devices to ensure normal operation.	Monthly
Emergency stop function test	Regularly test the emergency stop function to ensure its reliability.	Monthly
Environmental condition monitoring	Monitor the temperature, humidity, dust, etc. of the working environment to ensure that it meets the operating specifications of the robot.	Continuous monitoring
Safety configuration review	Regularly check and confirm the safety configuration of the robot, such as speed limit and working range settings.	Monthly
Preventive maintenance plan execution	Perform regular inspections and maintenance according to the manufacturer's maintenance plan.	By Manufacturer's Guide

Guide to Independently Changing Robot Hardware

We understand that customers may have the need to upgrade or repair robot hardware by themselves. Before performing any upgrade operations, please be sure to read the relevant parameters of the product in detail and confirm with our official personnel whether such operations are allowed. Operations without official permission may cause product failure and are not covered by the warranty.

Material Requirements

Officially manufactured or recommended materials: All accessories and components required for repairs and upgrades must be officially manufactured or explicitly recommended by us. This includes but is not limited to electronic components, sensors, motors, connectors, and any other replaceable parts.

Material Acquisition: Customers can purchase the required repair and upgrade materials through our official channels. This ensures the quality and compatibility of the accessories.

Repair or Upgrade Process

Customer Self-Repair: Customers are responsible for completing the repair work. We will provide detailed repair instructions and manuals to guide customers through the repair steps.

Follow official instructions: Repair operations should strictly follow the official instructions provided by us. Any deviation from the official instructions may cause damage to the equipment.

Liability and Warranty Policy

- Division of Responsibilities: Manufacturer: Provide official instructions for repairs and upgrades, officially manufactured or recommended materials, and handle problems caused by manufacturing defects. Customer: Responsible for completing repairs in accordance with official instructions and using official accessories.
- Warranty Policy: Warranty Valid: Warranty is valid only if the repair operation fully follows our instructions and uses official accessories. Warranty Void: If the customer does not follow the official instructions or uses unofficial accessories for repairs or upgrades, any damage caused will not be covered by the warranty.

Notes

- Safety First: Before performing any repair or upgrade operations, please make sure to follow all safety guidelines, including powering off and using appropriate protective equipment.
- Technical Support: If you encounter problems during the repair process, it is recommended to stop the operation and contact our technical support team for assistance.

We strongly recommend that customers strictly follow these guidelines to ensure the safe and effective operation of the robot equipment. Improper repair operations may cause damage to the equipment and affect the warranty status. For further guidance or support, please contact our professional technical team in a timely manner.

If you have read all of this chapter, please continue to the next chapter.

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Product Standard List

1.Product List Image

> Thank you for choosing the Elephant Robot myCobot 280 pi Robotic Arm. This chapter is designed to help you easily get started with the Elephant Robotic product and enjoy every wonderful moment brought by the product.

Product Standard List Comparison Table

Serial Number	Product
1	myCobot Robotic Arm (Model myCobot-280 pi)
2	myCobot Robotic Arm-Product Brochure
3	myCobot Robotic Arm-Supporting Power Supply
4	USB-Type C
5	Jumper

Note: After the packaging box arrives, please confirm that the robot packaging is intact. If there is any damage, please contact the logistics company and the supplier in your area in time. After unpacking, please check the actual items in the box according to the item list.

2.Product Unpacking Guide

Product Unpacking Graphic Guide

Why do you need to disassemble the product according to the steps

In this section, we strongly recommend disassembling the product according to the specified steps. This will not only help ensure that the product is not damaged during transportation, but also minimize the risk of unexpected failures. Please read the following graphic guide carefully to ensure the safety of your product during the unpacking process.

- **1** Check whether the packaging box is damaged. If there is any damage or missing accessories, please contact the logistics company and the supplier in your area in time.
- **2** Open the box and take out the product brochure, sponge packaging cover, myCobot robot arm, matching power supply and accessory bag.
- **3** Make sure each step is completed before proceeding to the next step to prevent unnecessary damage or omissions.

Note: After taking out the product, please carefully check the appearance of each item. Please check the actual items in the box against the item list.

3.Product unboxing video guide

Video Title

4.Power-on inspection guide

Structural installation and fixation

During the movement of the **robot arm**, if the **bottom surface of myCobot is not connected to the desktop or other bottom surface**, myCobot will still **shake or overturn**.

There are three common ways to fix the robot arm:

1) Use the Lego key to fix it on a base with a Lego interface We sell two types of bases: flat suction cup base and G-type clamp base

Flat base Applicable model: myCobot 280

- Install suction cups at the four corners of the base and tighten them.
- Use the included Lego technology parts to connect the flat base and the bottom of the robot arm.
- Fix the four suction cups on a flat and smooth surface before starting to use.
- Tips: You can add a small amount of non-conductive liquid under the suction cup to fill the gap between the suction cup and the desktop to obtain the best adsorption effect.

G-type base Applicable models: myCobot 280, myPalletizer 260

- Use the G-shaped clip to fix the base to the edge of the table

- Use the included Lego technology parts to connect the base and the bottom of the robot arm
- Make sure it is stable before starting to use

2 myCobot base screw hole connection

The robot needs to be fixed on a solid base before it can be used normally. Base weight requirements: fixed base, or mobile base.

Please make sure that there are corresponding threaded holes on the fixed base before installation.

Before formal installation, please confirm:

- The installation environment meets the requirements of the above "Working Environment and Conditions" table.
- The installation location is not less than the robot's working range, and there is enough space for installation, use, maintenance, and repair.
- Place the base in a suitable position.
- The installation-related tools are ready, such as screws, wrenches, etc.

After confirming the above content, please move the robot to the base installation table, adjust the robot position, and align the robot base fixing holes with the holes on the base installation table. After aligning the holes, align the screws with the holes and tighten them.

- Note: When adjusting the robot position on the base installation table, please try to avoid pushing and pulling the robot directly on the base installation table to avoid scratches. When manually moving the robot, please try to avoid applying external force to the fragile parts of the robot body to avoid unnecessary damage to the robot.

5.Power on and preliminary test

Power on the robot

Before operation, please make sure that you have read and followed the contents of **Chapter 3 Safety Instructions** to ensure safe operation. At the same time, connect the power adapter to the robot arm and fix the base of the robot arm on the table. The connection method is shown in Figure 3-1:

Figure 3-1

myCobot **must be powered by an external power supply** to provide sufficient power:

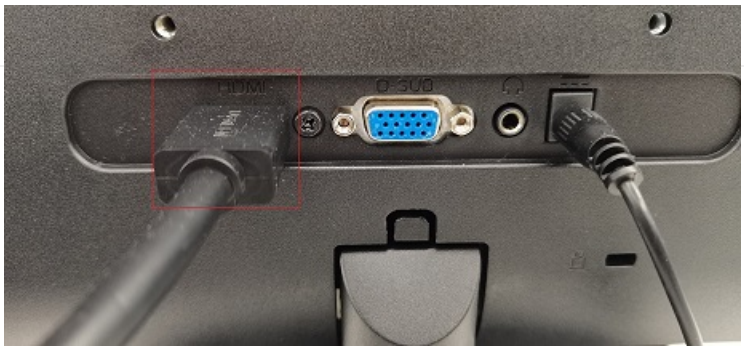
- Rated voltage: 12V
- Rated current: 3-5A
- Plug Type: DC 5.5mm x 2.1

Note that **cannot be powered by just the TypeC plugged into the M5Stack-basic**. Use the official power adapter to avoid damage to the robot arm.

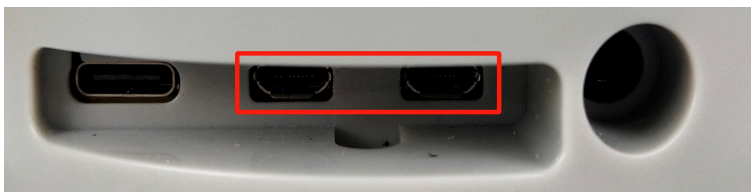
Connect external devices

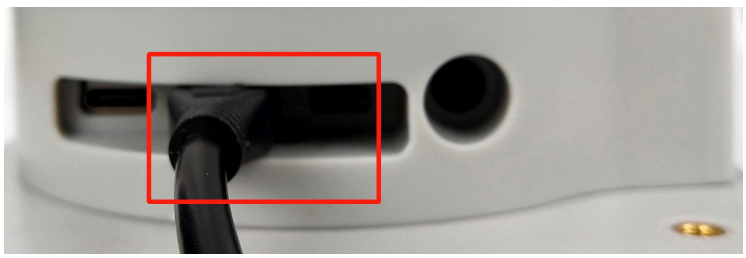
Use the matching HDMI cable to connect the robot arm and the monitor:

- First insert the HDMI cable into the HDMI port of the monitor.



- Then insert the other end into the HDMI port of the robot arm.

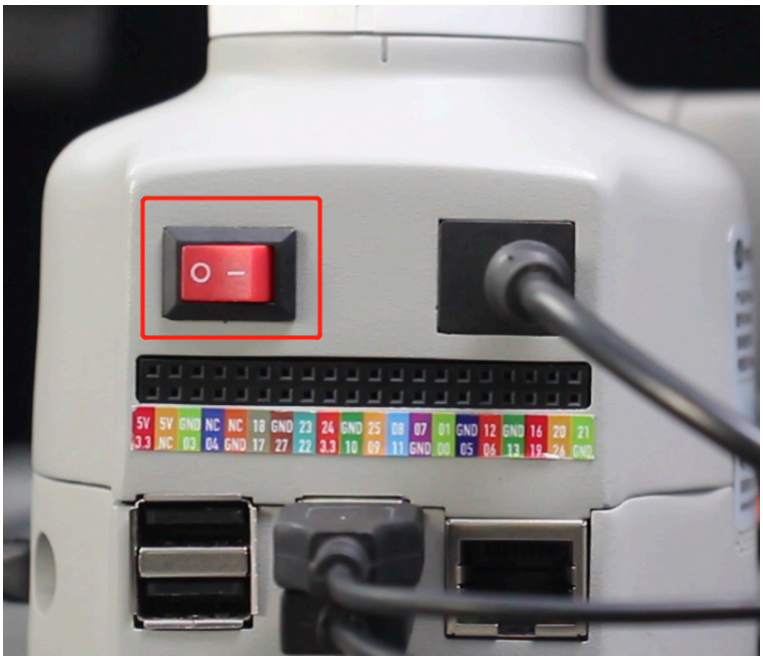




- myCobot 280 has 4 USB ports, which can be directly plugged into a mouse, keyboard and other peripherals.

Power on

After connecting the required external devices, press the red power button to start the machine



>>> Unboxing video.

Product first use guide video

5.Common Problem Solving

This section aims to help users solve common problems encountered during use, covering hardware, software, accessories, and how to self-check for the first time. If you encounter problems while using the robot arm, please read the contents of this section first to find solutions. If the listed problems cannot help you solve and you have more after-sales questions to consult, please add the after-sales butler WeChat.

First-time self-check

Common software problems and solutions

Common hardware problems and solutions

Common accessories problems and solutions

Other problems and solutions

If you have read all the contents of this chapter, please continue to the next chapter.

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First-time self-check- Machine Joint Function Verification

> **Note:** When starting the robot arm, please be careful not to let the robot arm be in a curled-up or touching position between joints. It is recommended that the robot arm posture should be as shown in Figure 1 below when starting. Figures 2 and 3 are both incorrect starting postures:

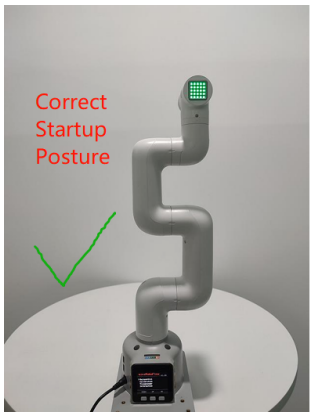
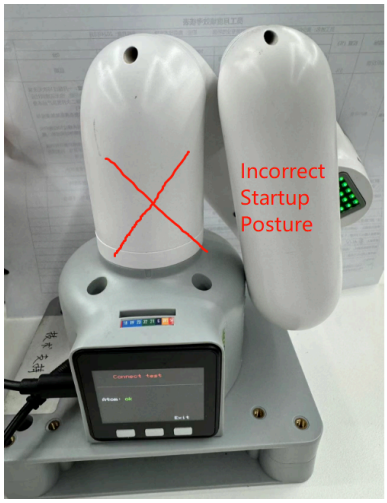
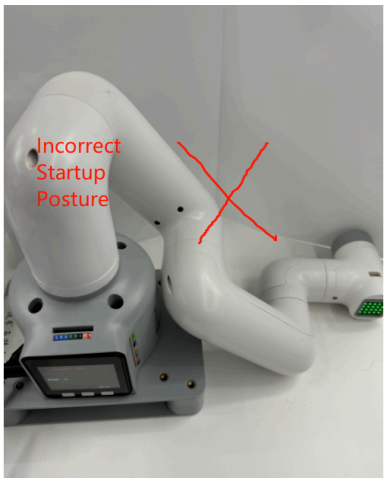
		

Figure 1 (Correct Posture)	Figure 2 (Incorrect Posture)	Figure 2 (Incorrect Posture)

Joint control method steps

1. Make hardware connections

- Hardware connections for M5 series machines:

Make sure the M5 series robot is connected to the power adapter and USB data cable.

2. Install and configure the software environment

You need to prepare a computer to use the M5 version of the machine. Install python, pymycobot library and USB serial port driver on the computer. For details, please refer to the environment configuration section of gitbook.

3. Choose the correct communication method

Before using each communication method, you need to make sure that the LCD screen of M5 is adjusted to the corresponding mode and maintain this communication state to control the robot arm normally. When using myblockly, python, ros and other development methods for the M5 robotic arm, you need to ensure that the M5 LCD screen stays on the Atom: ok interface, as shown below:### 1. Hardware connection of PI series machines:

Mycobot280PI and mech270PI series robotic arms need to be connected to the power adapter. It is recommended to connect the 280pi to the HDMI screen via an HDMI cable, and connect the keyboard and mouse to the USB interface of the 280pi.

2. Install and configure the software environment

When using the PI or JN version machine, you need to prepare an HDMI screen instead of your own computer. After connecting the HDMI screen, you can directly enter the system interface of the 280pi machine. Since the factory system has configured the software environment, you do not need to install tools such as python, pymycobot and USB drivers yourself, and you can use the robotic arm use case.

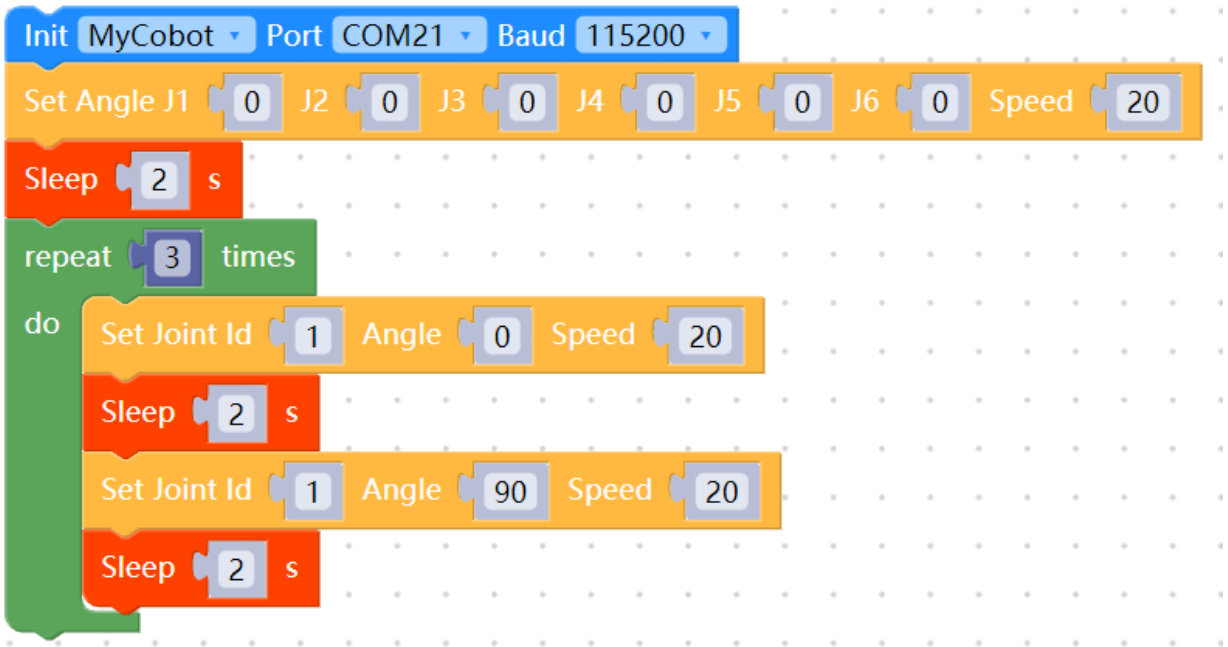
3. USB communication example

Please use myblockly or python source code examples to verify the joint motion of the robotic arm.

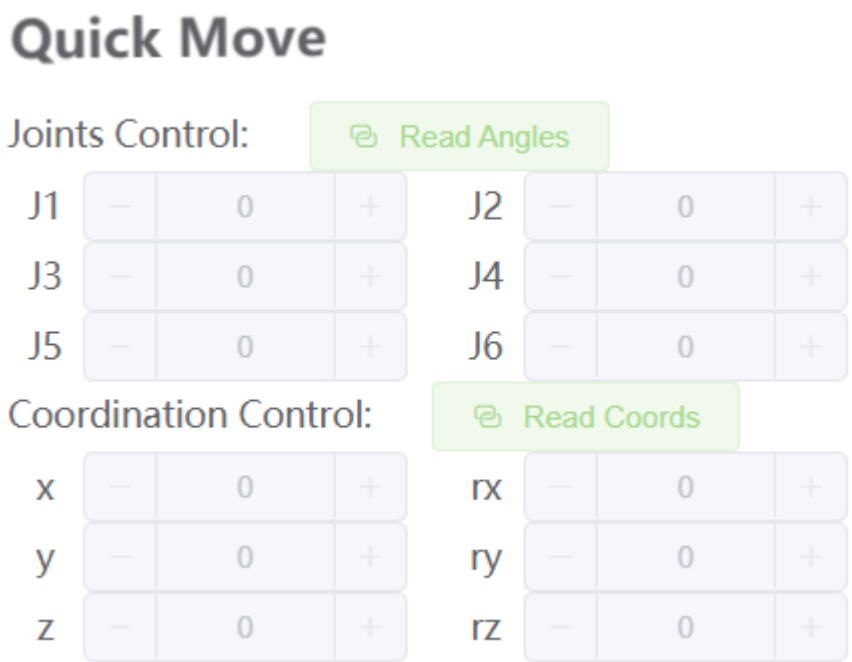
Pay special attention to the need to select the corresponding serial port and baud rate when using the USB serial port opening method so that the robot arm can communicate with the computer normally and control the robot arm normally: The following is the corresponding information of the corresponding model, serial port and baud rate:

Machine model	Serial port number	Baud rate
260 M5	Win: COM; Linux: /dev/ttyUSB	115200
270 M5	Win: COM; Linux: /dev/ttyUSB	115200
280 M5	Win: COM; Linux: /dev/ttyUSB	115200
280 AR	Win: COM; Linux: /dev/ttyUSB	1000000
280 PI	/dev/ttyAMA0	1000000
280 JetsonNano	/dev/ttyTHS1	115200
320 M5	Win: COM; Linux: /dev/ttyUSB	115200
320 PI	/dev/ttyAMA0	115200
280 PI	/dev/ttyAMA0	1000000
270 PI	/dev/ttyAMA0	1000000

3.1 Robotic arm joint movement myblockly source code



When you see the robot arm joint 1 cycle 3 times from 0 to 90 degrees, it means that the robot arm joint 1 responds normally. You can try to change the joint ID to test other joints and learn other cases in gitbook step by step or use the robot arm to do various interesting things! It is worth mentioning that if you are not familiar with the code block development method of myblockly, there is also a relatively quick way to verify the joints: use the myblockly fast movement tool to perform simple joint motion control. For specific usage, please refer to: Myblockly fast movement tool usage



3.2 Robotic arm joint motion joint python source code

```
#The motion effect is that the robot arm moves around the zero position, and the 1-6 joints move one by one ±20 degrees
import time
from pymycobot import MyCobot280

if __name__ == "__main__":
    cobot = MyCobot280('com22',115200)#Select the corresponding port number and baud rate according to the model
    cobot.set_fresh_mode(1)
    cobot.send_angles([0, 0, 0, 0, 0, 0], 20)
    time.sleep(2)
    print("start")
    for i in range(1,7):
        cobot.send_angle(i, (-30), 20)
        time.sleep(2)
        cobot.send_angle(i, (30), 20)
        time.sleep(2)
        cobot.send_angle(i, (0), 20)
        time.sleep(2)
```

When you see the robot arm around the zero-position posture, 1-6 joints move one by one ±20 degrees, indicating that joints 1-6 respond normally, you can gradually learn to use other cases in gitbook or use the robot arm to do various interesting things!

If you do not see the corresponding effect when executing the case, please refer to the common problem solutions below. In addition, please make sure that you have checked the following 5 points before contacting technical support personnel:

1. Can the robot arm lock normally after power-on? If it cannot be locked, please refer to FQA hardware-related questions: "Q: How to solve the problem that the robot arm cannot be locked after power-on?" for troubleshooting
2. If you have an M5 series robot arm, is your computer connected to the USB port on the side of the M5stack via type-c?
3. If you have an M5 series robot arm, is your screen LCD now stuck in the Atom: ok interface?
4. If you have an M5 series robot arm, the LCD interface shows Atom: no, please refer to "Q: How to solve the problem that the robot arm cannot be locked after power-on?" for troubleshooting
5. Is there any error message when running the code?

Please describe the usage details as detailed as possible. If convenient, please provide an operation video, which will help to quickly analyze and locate the problem. Thank you in advance!

Software Issues

1 myStudio related

Q: What is myStudio?

- A: It is our company's self-developed software. It is a tool for burning or modifying the firmware of the existing robot arm launched by our company.

Q: What is the method to troubleshoot the abnormal download of minirobot, Atom, and PICO firmware?

1. Check if the network connection is normal. You need to connect to the network before downloading the firmware.
2. Check if the line has been connected. The details are as follows: In the PI/JN series machines, when burning Atom, you need to use a USB cable to connect the Atom interface at the end to the Raspberry Pi USB port;

For example: Video of burning Atom on 280pi: https://drive.google.com/file/d/1ErsdxNe-VT9_n34Gf-5yLK1DDQvCWgbq/view?usp=sharing

1. Select the firmware of the corresponding model, and don't choose the wrong model.
2. Download and install the driver. If it still cannot be recognized after downloading the driver, try to replace the latest ch340 driver. If the port number still cannot be displayed after installing the driver and the system is a win11 model, try How to install the CH340 driver in Win11 system.
3. Try to change a USB cable, USB port or computer to download it to avoid abnormal firmware download caused by the cable not having data transmission function.
4. Uninstall mystudio and reinstall mystudio in a non-C drive location, such as installing mystudio in the D drive. When mystudio is installed in the C drive, the file permissions are relatively strict, and the firmware may not be burned.

Q: Why does the device not work properly after I burn the firmware to the ATOM terminal?

- A: The firmware of the ATOM terminal needs to use our factory firmware. Other unofficial firmware cannot be changed during use. If the device accidentally burns other firmware, you can use "myCobot firmware burner" to select ATOM terminal-select serial port-select ATOMMAIN firmware to burn the ATOM terminal.

Q: Can the drag teaching in the firmware record the gripper action?

- A: It is temporarily impossible to use drag teaching to record the gripper action, because the gripper belongs to joint number 7, and our drag teaching can only record and play the movement of joints numbered 1-6.

Q: Why can't drag teaching be performed after burning the minirobot firmware?

- A: First check whether the M5Stack-basic firmware and atom firmware are burned, whether the burned firmware corresponds to the requirements to be implemented, and whether the burned firmware is the latest version of the firmware.
- It is recommended to burn the minirobot firmware to version v2.1 and the top atommain firmware to version v4.1 and above (need to support mystudio version v4.3.1 and above).

Q: What should I do if mycobot's serial port cannot be recognized on mystudio?

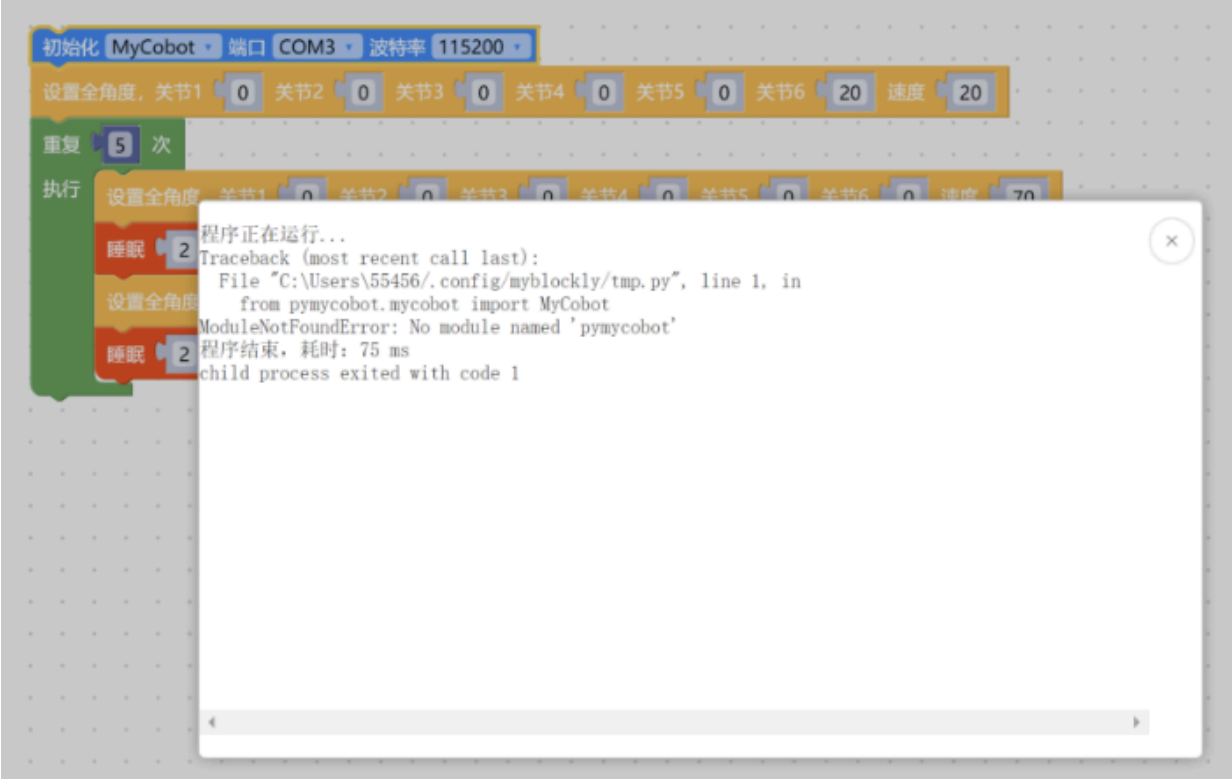
- A: If your computer device does not prompt for the connected robot arm, please install the serial port driver first.
- In addition, it should be noted that the Raspberry Pi, Arduino and Jetson nano series robot arms are **cannot be connected to a laptop using a data cable**, and you need to use mystudio in the built-in system to burn the firmware.

Q: Can the trajectory recorded by dragging teaching be saved to the card?

- A: It cannot be saved to the memory card at present. And dragging teaching can only save one path at a time, and the next recording will overwrite the previous action.

2 myblockly related

Q: How to deal with the error message: ModuleNotFoundError: No module named "pymycobot"?



- A: The error message prompts that the pymycobot file is missing, including the reasons and solutions, refer to the following 3 points: ①If pymycobot is not installed or pymycobot has an error, the corresponding solution is to reinstall pymycobot, the command is pip3 install pymycobot --upgrade --user

Q: How to deal with the fact that myblockly's express delivery mobile tool cannot display the real-time angle?

- A: This is generally caused by incorrect selection of device serial port information and pymycobot exception. It is recommended to check according to the "First Use Self-Check" solution in this article. If the robot arm cannot be controlled normally, please try to update pymycobot. The corresponding update solution is to enter the command `pip install pymycobot --upgrade --user` in cmd or terminal. Finally, if it still cannot be controlled normally, please try to update the myblockly software. Please refer to the following link for the update method: https://drive.google.com/file/d/1yBWzhbSBUYsZPBl7PBdZKRwk3al71Dc7/view?usp=sharing

Q: The result of running the program shows child process exited with code 1. Is it normal?

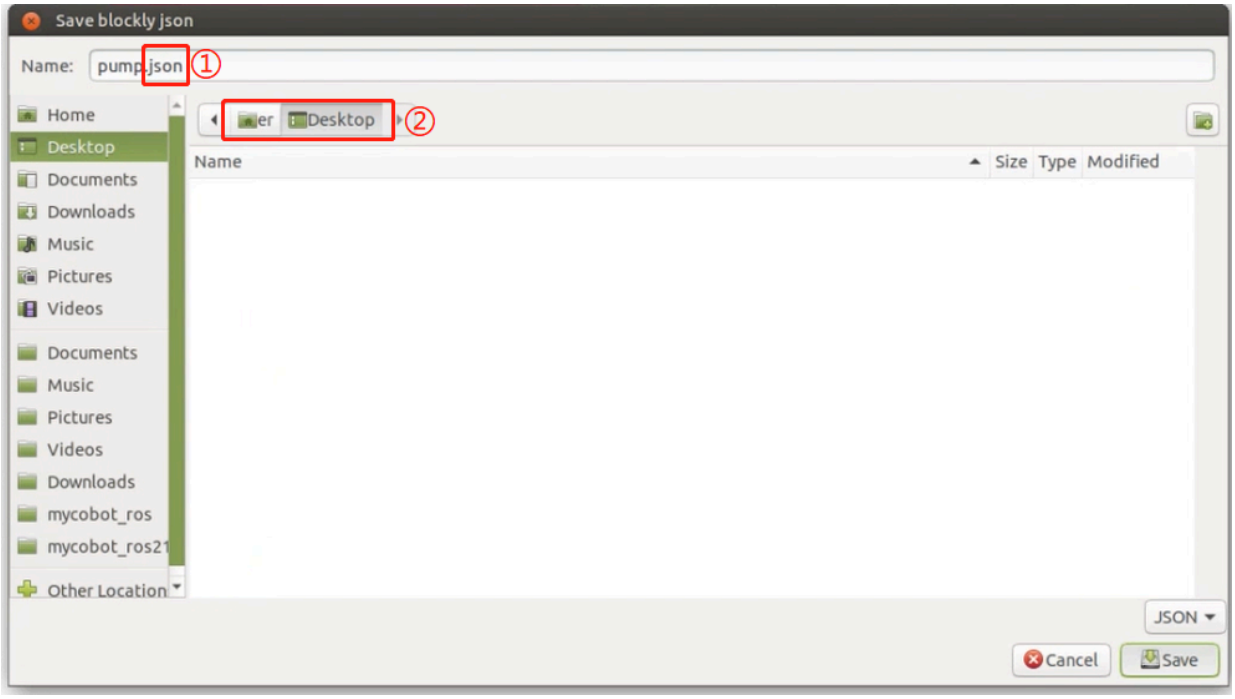
- A: This is not an error. All programs have finished running and returned the binary number 1. It means that all have been successfully run.

Q: Why does the myblockly program not take effect or cannot find the file when saved in PI or JN?

①You need to add ".json" to the file extension when saving, for example: "pump.json"

②You need to confirm the path to save and find the saved file in the saved path

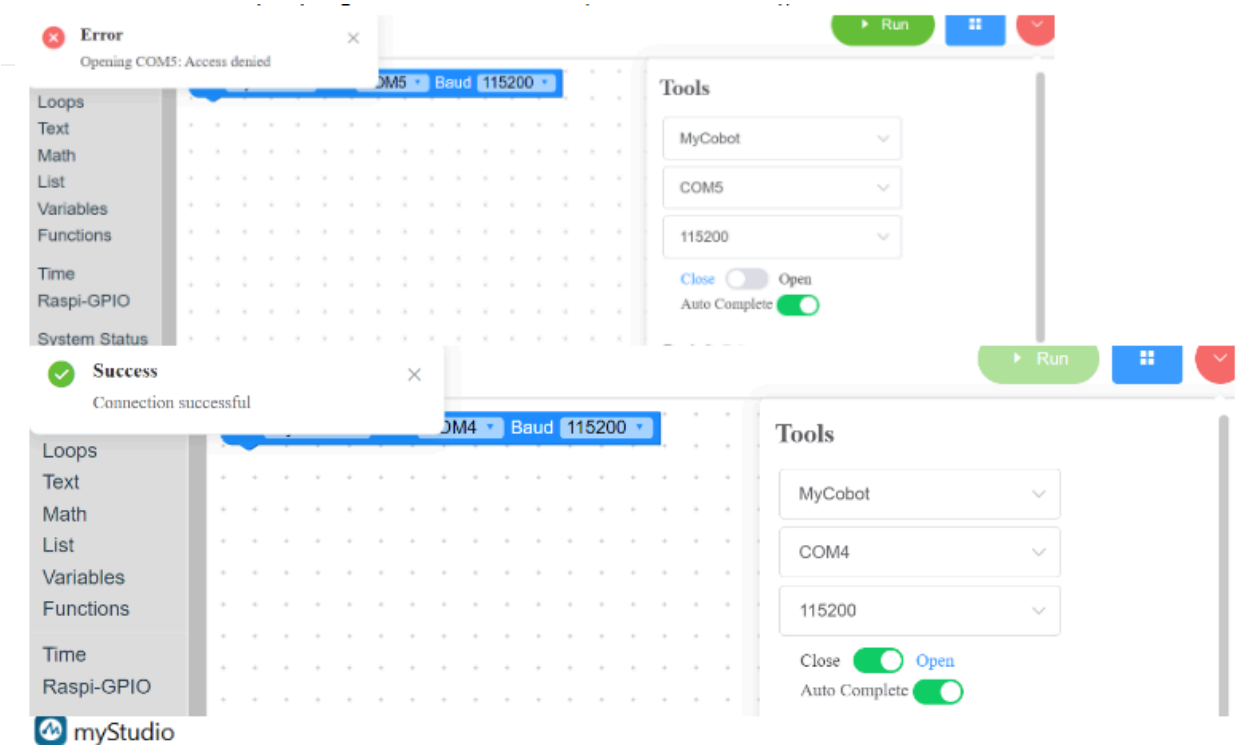
You can refer to the video: https://drive.google.com/file/d/1g_dd933TK1tptnisUad4PBfwSRsWWFeQ/view?usp=sharing



Q: How to preset the code block content in myblockly, including the model, baud rate and other information after entering the system, which are all corresponding to the connected model?

A: At present, the default model for the first startup in myblockly is mycobot and the baud rate is 115200. There is no way to change the initial baud rate for the time being, but you can save an initialization json file yourself. Load this file after entering myblockly next time to get the preset code block. Please refer to the following for the method of making and saving json files: https://drive.google.com/file/d/1g_dd933TK1tptnisUad4PBfwSRsWWFeQ/view?usp=sharing

Q: Why is the connection rejected when selecting a certain com port? Or how to find the corresponding com port?



The reason for the connection rejection is due to the wrong com port selection. When you have multiple devices connected to the computer USB, multiple serial ports will be displayed in myblockly, such as com4 and com5 in the above picture, but only one of them is the robot arm. You need to select the serial port of the robot arm to connect and use the robot arm normally. Obviously, the com4 that can be connected normally is the serial port number corresponding to the current robot arm. Regarding how to find the serial port corresponding to the robot arm among multiple serial ports, the corresponding method is: try to unplug the serial port cable connected to the robot arm, and check which serial port number disappears in the serial port number option of myblockly after disconnecting the USB connection between the robot arm and the computer. When the USB is used again to connect the robot arm to the computer, this serial port number appears in the serial port number option of myblockly. The serial port number that disappears and reappears in myblockly with the disconnection and connection of the robot arm and the computer is the serial port number corresponding to the robot arm. Note that the option of the robot arm com port number is not always fixed. It may change when connected to the USB port of different computers or different USB ports of the same computer. It is recommended to view the real-time com port number using the above method.

Q: Error MyCobot.*int*() takes 2 positional arguments but 3 were given.

This error will appear in the old version of myblockly. The reason is that the versions of myblockly and pymycobot do not match. It can be solved by updating the versions of myblockly and pymycobot driver libraries. For M5 version machines, please download the latest myblockly from the official software download page; for pi and jn version machines, please refer to the link: https://drive.google.com/file/d/1yBWzhbSBUYsZPBI7PBdZKRwk3aI71Dc7/view?usp=sharing The command to update pymycobo is `pip3 install pymycobot --upgrade --user`

3 Roboflow Related

Q: What should I do if I cannot download the Roboflow software or if Roboflow fails to properly control the robot?

- A: Currently, the Roboflow software only supports the 600 Pro and 630 Pro (two professional collaborative robot models). It no longer supports the Mycobot collaborative series or other robot models. For Mycobot-series robots, it is recommended to use MyBlockly, Python, or ROS for control. Notably, MyBlockly is a software with a

graphical interface similar to Roboflow. If you prefer visual, block-based programming, MyBlockly is the preferred choice.

4 Python related

Q: The running prompt is missing library filesQ: The error message: ModuleNotFoundError: No module named "pymycobot", how to deal with it?

- A1: Pymycobot is not installed. The corresponding solution is to reinstall pymycobot. The command is `pip3 install pymycobot --upgrade --user`

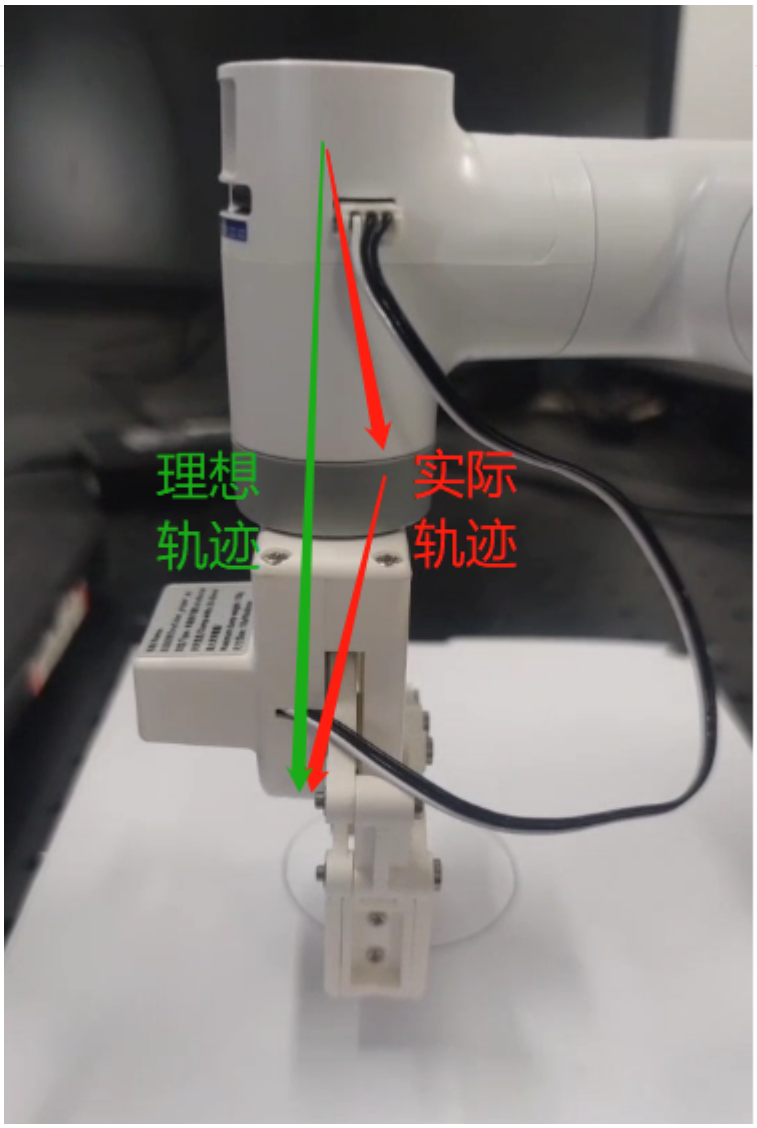
Q: Is there a more popular explanation for the mode in send_coords(coords, speed, mode)?

- A: Linear 1 means that the end of the robot reaches the target position in a straight line. If it cannot go in a straight line due to limitations, structure, etc., the command will not be fully executed; Linear 0 means that the end reaches the target position in an arbitrary posture. Since there is no straight line restriction, it is not easy for the command to not be executed.

Q: What is the difference between the interpolation and refresh modes of set_fresh_mode(mode)?

- A: Interpolation 0 means that many dense points are planned between the starting point and the end point, so as to achieve the effect of controlling the trajectory of the middle segment. How to achieve the effect of program parallelism: Non-interpolation 1 means that there is no planning of the middle segment, and the trajectory cannot be controlled, but the movement will be relatively smooth.

Q：Is it normal for the trajectory not to be straight up and down when only the Z-axis is changed, but the final landing point is adjusted only in the Z-axis? How can the middle trajectory be ensured to be straight?



- Turn on interpolation and walk in a straight line to ensure the trajectory

```
set_fresh_mode(0) # Turn on interpolation
send_coords(coords, speed, mode=1) # Walk in a straight line
```

Note that the intelligent planning route set in send_coords will only be useful after turning on interpolation. Interpolation means that many dense points are planned between the starting point and the end point, so as to achieve the effect of controlling the trajectory of the middle section. Non-interpolation means that there is no planning of the middle section, and the trajectory cannot be controlled.

Q: What does the return value of get_error_information() being -1 mean?

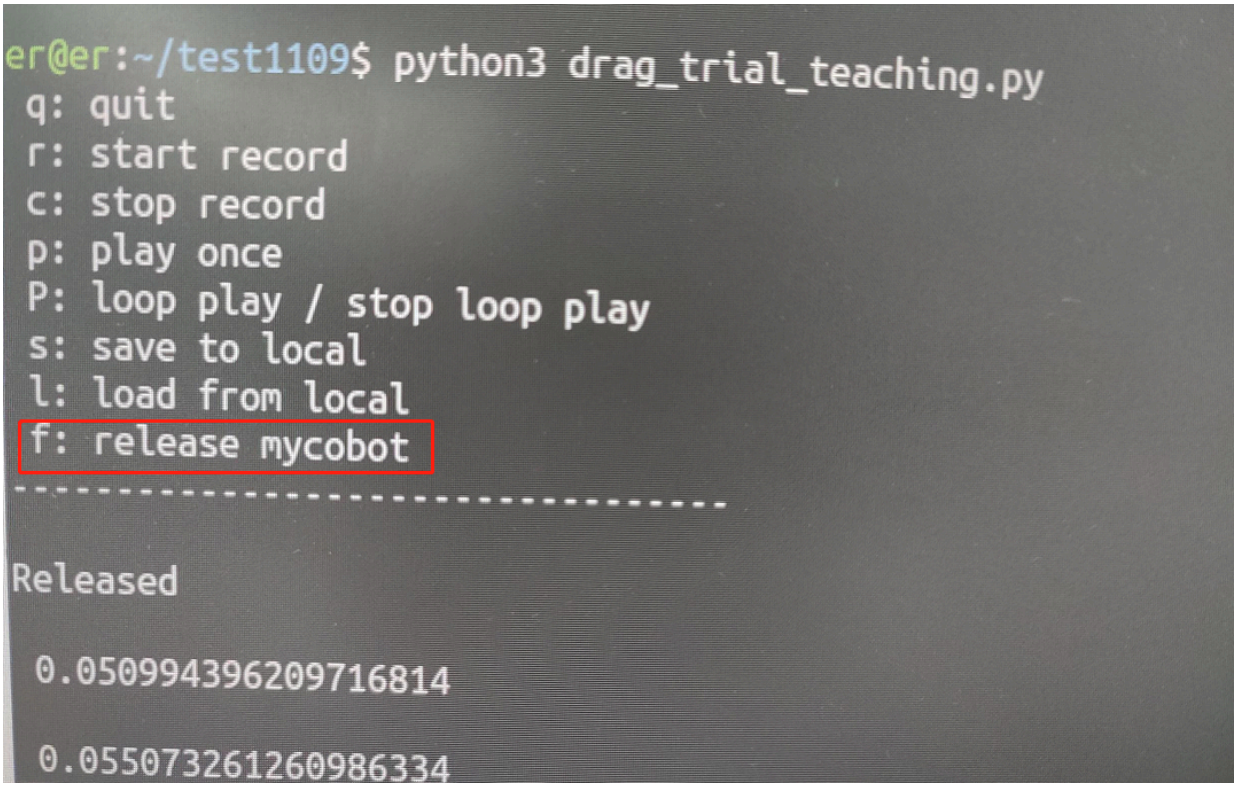
- A: The return value of `get_error_information()` is -1, indicating that communication is not possible. You need to check whether the power adapter and USB cable are connected, and whether the LCD screen stays on the Atom: ok interface. If the line is not connected successfully and does not display ok, communication abnormalities will occur. You need to reconnect and test again.

Q: What should I do if the drag teaching function cannot be used on 280JN?

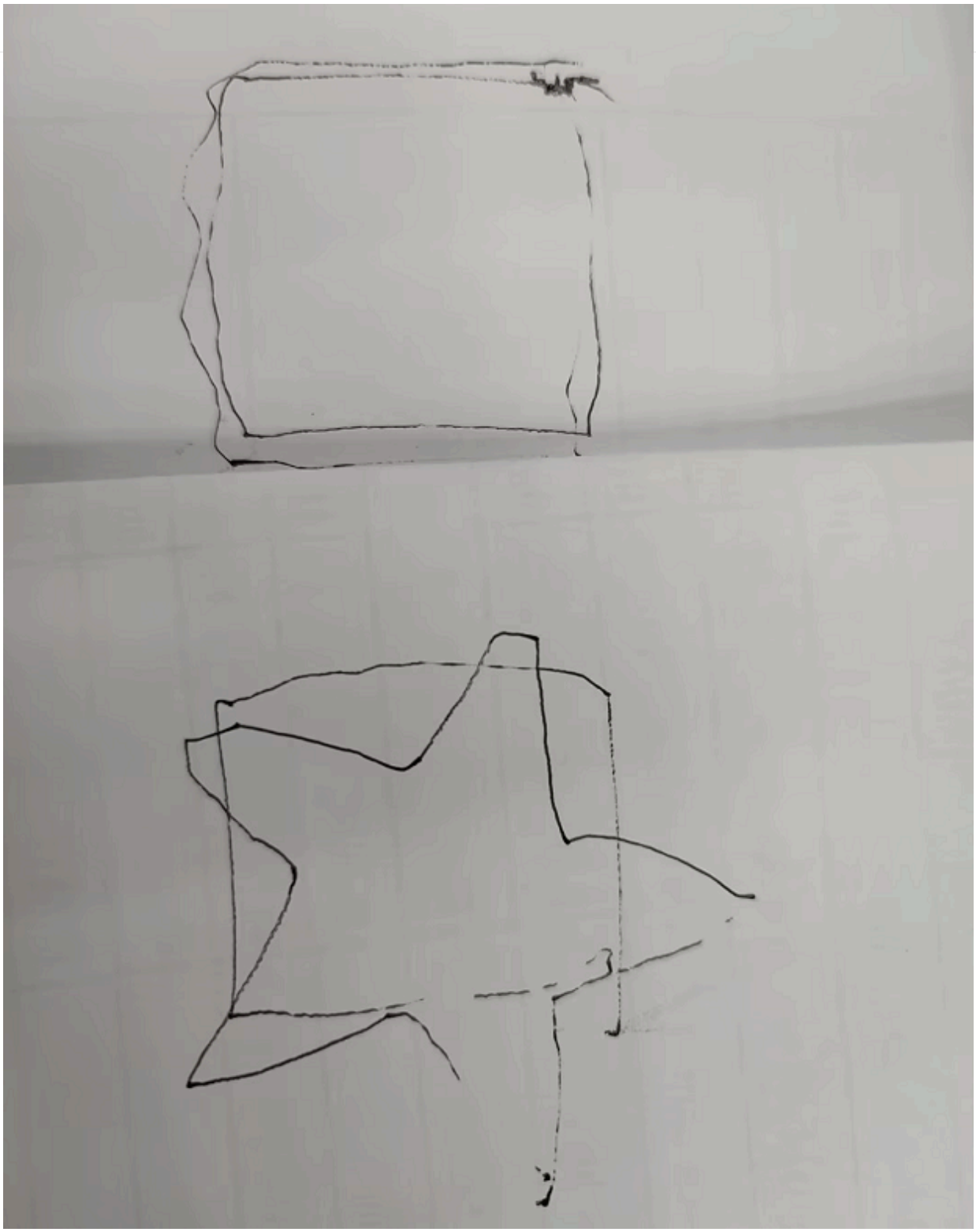
1. Please download the latest source code from github, do not use the source code file that comes with the system directly

2. You need to update pymycobot to 3.9.7, pip install pymycobot==3.9.7

3. Please note that you must press f to release the joint and then press r to record. Pressing r directly in a locked state will not allow dragging



Q: In the case of drawing with a 280 machine, it is found that the shape trajectory is not very straight. Can it be optimized?



- A1: It is normal to get a deviation in the trajectory when using a signature pen or hard stationery to draw this case. There are two main reasons for this deviation. First, mycobot uses a servo motor, which has a certain accuracy deviation (if it is a machine that has been used for a long time, the deviation of its joints will be greater due to aging of the joints). Second, when using a hard pen to draw, the contact distance with the desktop is relatively demanding. If the distance is too high, the trajectory is prone to interruption. If the distance is too low, the pen tip resistance will be too large and the drawing effect is not ideal. It is currently recommended to use soft stationery for drawing, such as brushes and other tools, which will help improve the drawing effect.

- A2: In addition, you can change the motion mode of the robot arm to interpolation mode, so that the motion trajectory will be relatively straight.

```
set_fresh_mode(0) # Enable interpolation
send_coords(coords, speed, mode=1) # Go straight
```

Note that the intelligent planning route set in send_coords will only be useful after interpolation is turned on. Interpolation means that many dense points are planned between the starting point and the end point to achieve the effect of controlling the trajectory of the middle section.

Q: What to do if you encounter an error when updating pandas?

A: If you encounter a "no suitable distribution found" error when trying to install pandas to Python, there are several steps you can take to try to resolve this issue: Update pip: Make sure you have the latest version of pip installed, run

```
pip install --upgrade pip
```

Use the latest version of Pandas, as they often contain the latest features and fix known bugs.

```
pip install pandas --upgrade
```

Use a specific version: Instead of installing the latest version, try installing a specific version of pandas that is known to be compatible with your version of Python. For example

```
pip install pandas==1.1.5
```

Use a virtual environment: Create a virtual environment for your project and try to install pandas in that environment. This helps isolate dependencies and avoid conflicts with other packages.

```
python -m venv myenv
source myenv/bin/activate # Activate virtual environment on Unix/Linux
myenv\Scripts\activate # Activate virtual environment on Windows
pip install pandas
```

Please note that you should check your network connection and repository: Make sure you have a stable network connection and can access the Python Package Index (PyPI) repository where pandas is located.

Q: The target position is identified, but the end cannot reach it. How to determine whether this coordinate can be reached and then process it?

- A: Use solve inv kinematics(target coords, current_angles) to see if there is a solution. solve_inv_kinematics(target_coords, current_angles)
- Function: Convert coordinates to angles.
- Parameters:
- target_coords: list A floating point list of all coordinates.
- current_angles: list A floating point list of all angles, the current angle of the robot
- Return value: list A floating point list of all angles.

Q: 280jn uses socket to create a client script in the robot arm operating system, and the script reports an error: This module can only be run on a Raspberry Pi

A: All instructions related to the Raspberry Pi need to be commented out. The underlying driver library is different, and all GPIO instructions are commented out.

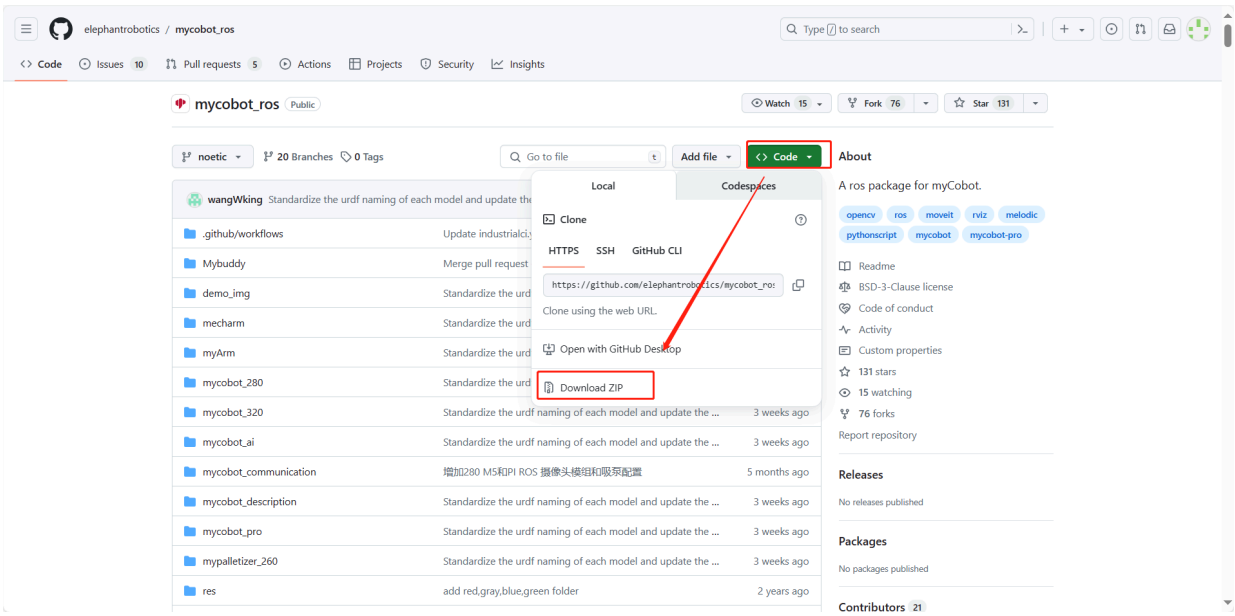
5 ROS related

Q: How to re-download the ROS source code package?

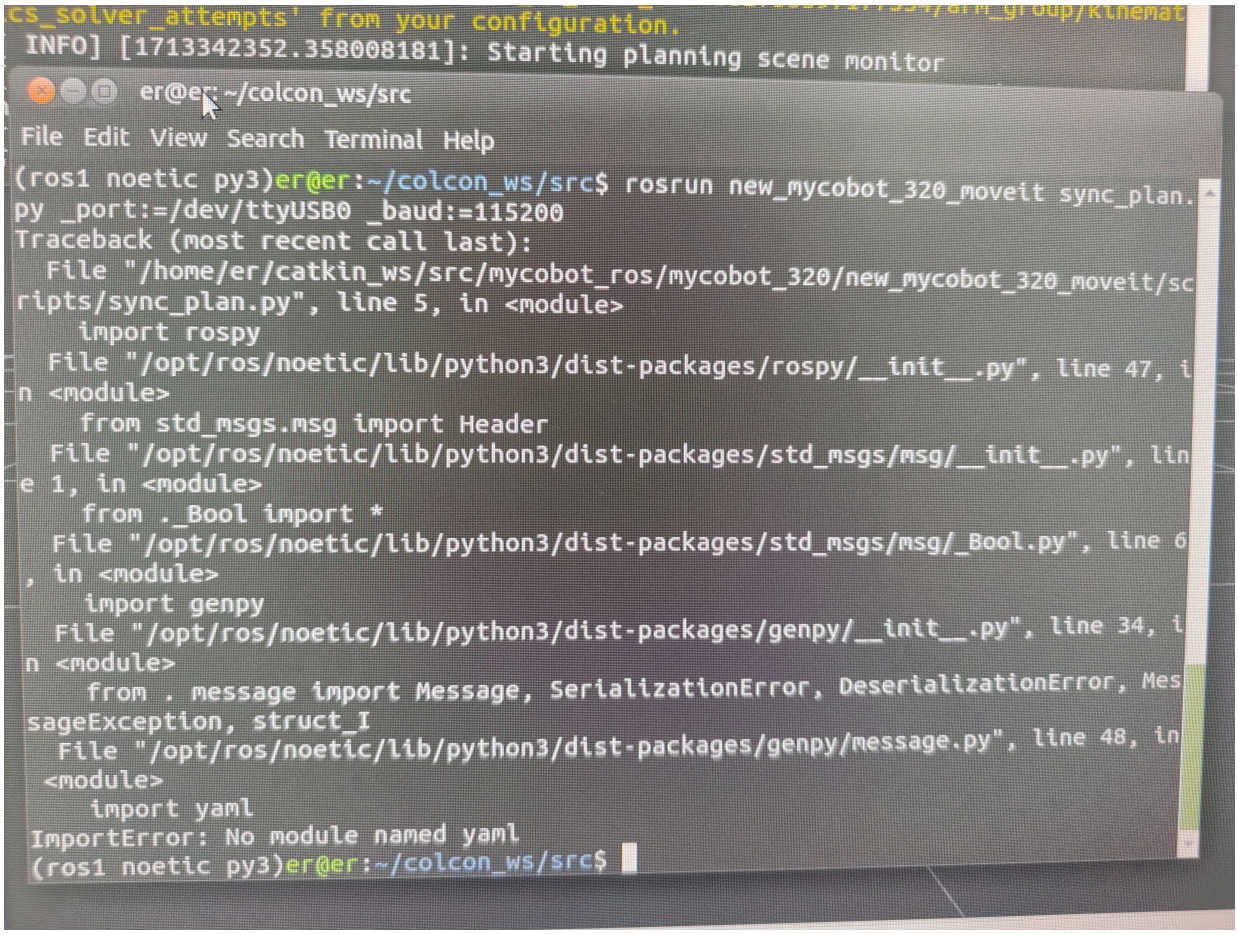
- A: Use the command to pull:

```
git clone https://github.com/elephantrobotics/mycobot_ros.git
```

Or download manually. The download method is to enter the ROS source code package address and follow the steps below. The source code package address is: https://github.com/elephantrobotics/mycobot_ros



Q: What should I do if I run the ROS moveit case and get an error ImprotError: No module named yaml?



- A: In the first line of this script, change the Python interpreter to python3

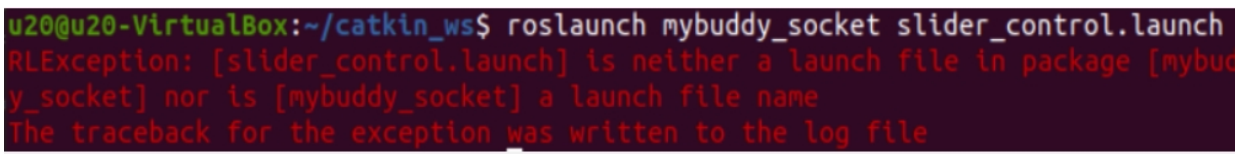
Q: Using a mujoco-based environment for simulation training, the robot's xml file is required

- A: Currently, there is only the 280JN xml file on GitHub: 280JN
- Provide customers with methods on how to convert dae and urdf files into xml files, and let customers use meshlab to convert by themselves.

Q: When the terminal switches to ~/catkin_ws/src and uses git to install and update mycobot_ros, the target path "mycobot_ros" already exists. What is the reason?

- A: This means that there is already a `mycobot_ros` package in `~/catkin_ws/src`. You need to delete it in advance and then re-execute the git operation.

Q: After the compilation is completed, why does the following error appear when the launch command is run in a new terminal?



- A1: The system does not add ros environment variables, so you need to source each time you open a new terminal:

```
cd ~/catkin_ws/
source devel/setup.bash
```

- A2: The system adds ros environment variables, and you do not need to execute source each time you open a new terminal:

```
# noetic is Ubuntu20.04 system
echo "source /opt/ros/noetic/setup.bash" >> ~/.bashrc
source ~/.bashrc
```

- A3: The file name in the command may be inconsistent with the actual file name in the mycobot_ros package. Please check the command carefully for errors.

6 C++ related

Q: What should I do if I can't find various dll files?

- A1: If myCobotCpp.dll is missing, put myCobotCpp.dl in the lib directory to the directory where mycobotcppexample.exe is located.
- A2: If QT5Core.dll is missing, open qt command (search QT in the menu bar), select msvc2017 64-bit, and execute windeployqt--release to the directory where myCobotCppExample.exe is located (such as: windeployqt --release D:lvs2019myCobotCpploutlbuildlx64-Releaselbin). If the vs installation path cannot be found after executing the command here, please check the settings of the vs environment variables.

After executing the above steps, if the qt5serialport.dll file is missing, move this file in the gt installation directory (path such as: D:lgt5.12.1015.12.10msvc2017 64bin), copy it to the directory where myCobotCppExample.exe is located

Q: Generate the myCobotCppExample.exe executable file, what could be the problem? Select the start

Hardware Issues

Q: How to put 280PI into the package?

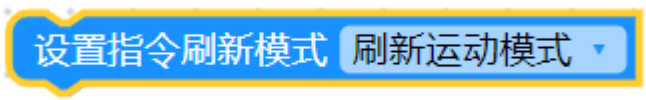
A: Refer to the picture below, put it into a W shape manually

Q: How to input audio into the Raspberry Pi system?

A: Raspberry Pi cannot use the 3.5 interface for audio input. The 3.5mm headphone jack does not support audio input. It cannot detect headphones and microphones. If you want to use the input and output audio method, you need to use a USB interface microphone or headphones

Q: How to optimize joint jitter, excessive joint angle deviation or joint weakness?

1. Refer to the robot parameter introduction section to check whether the actual load is within the effective load range of the robot arm. Excessive load will cause joint jitter. The load of the actual joint can be appropriately reduced.
2. Change the motion mode to refresh mode, so that the running trajectory of the robot arm will be relatively smooth. For specific APIs, please refer to set_fresh_mode(1)



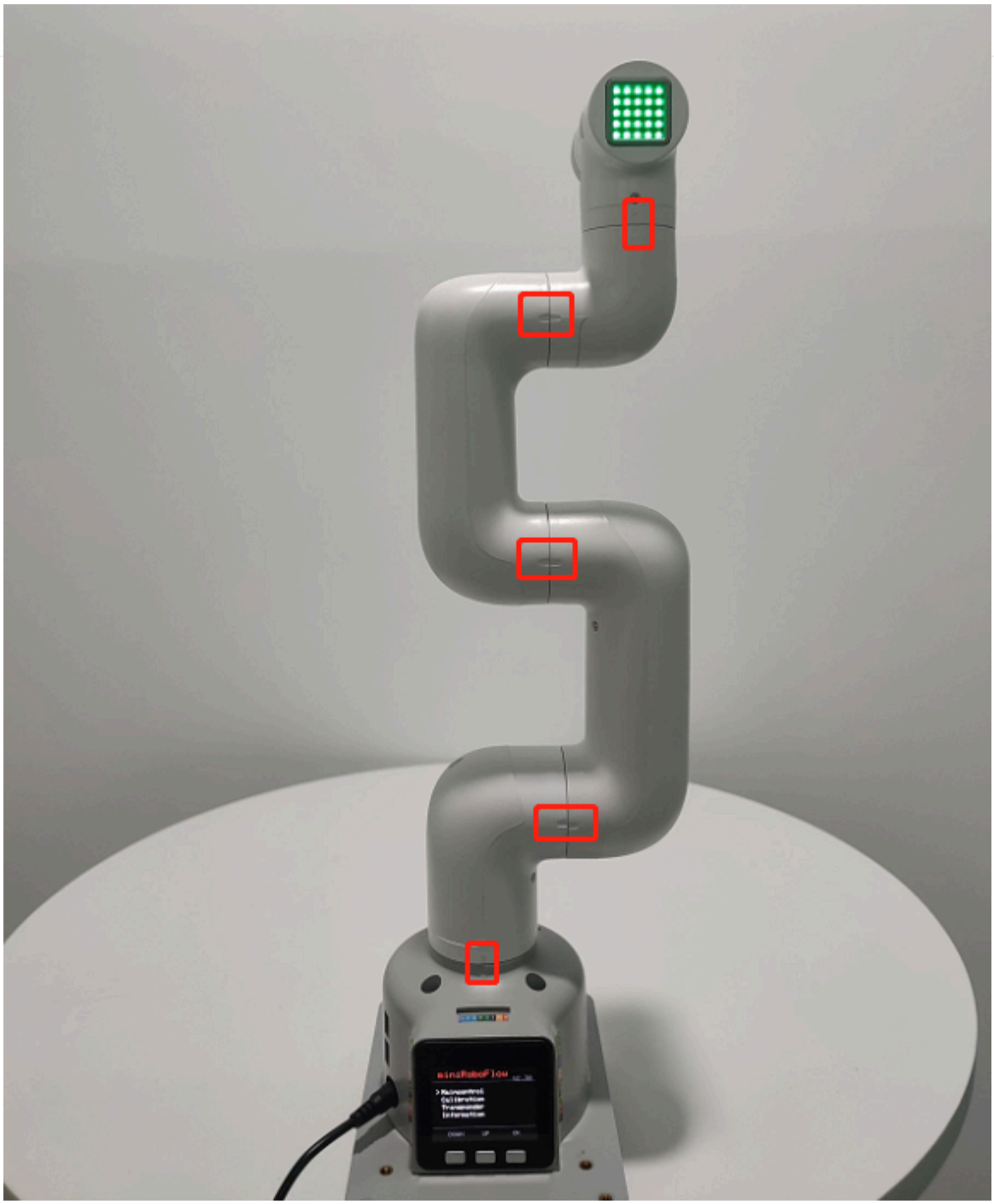
1. Check the following link to adjust pid:
   https://drive.google.com/file/d/1UWhaaSTuwLFImuEGY1J2tvgxTQDwWxK_/view?usp=sharing

2. Check the gitbook section and use mystudio to download the corresponding version of Atom firmware. It is recommended to download the latest
3. Check Chapter 5 of the gitbook to calibrate the robot arm at zero position. You can also refer to the calibration steps in the following link: https://drive.google.com/file/d/1XtKH-ykKWPH0q9Z_YHwzkgwNKRhstHhi/view?usp=sharing
4. For machines that have been used for a long time (more than 3 months), joints may age and produce joint gaps. You can follow the following video to manually bend the joints to check if there is any joint gap: https://drive.google.com/file/d/1tXDUALmfw1z0u6lM9uH5hOHivjbRoWxW/view?usp=sharing
5. If there is a joint gap problem due to joint aging, this kind of jitter is inevitable due to the natural aging of the machine.

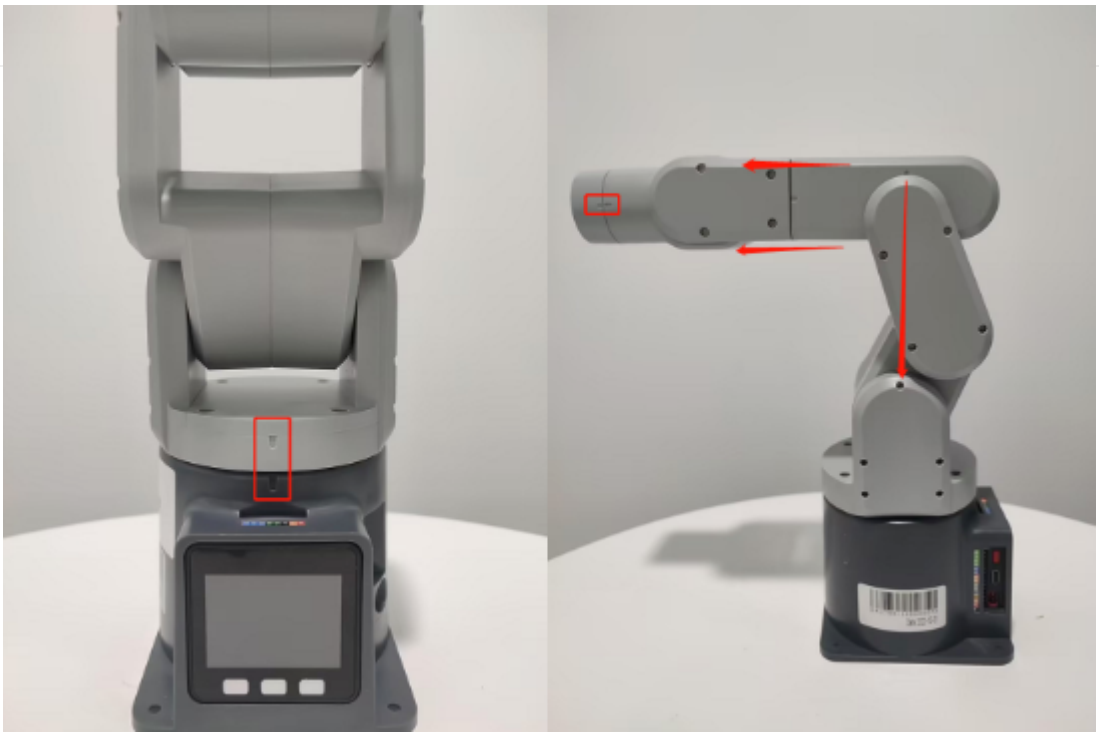
Q: What is the joint zero position?

Take the following figure as an example, there is an arched groove designed between the joint and the edge of the joint shell, which is the joint zero point

Generally, the zero point posture after calibration is as follows:



Pay special attention to the zero position posture of the 270 joint as follows:



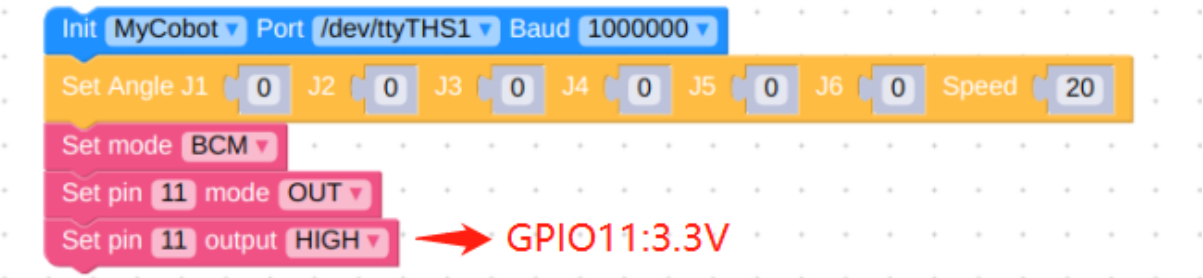
Q: Is there a method for zero point calibration?

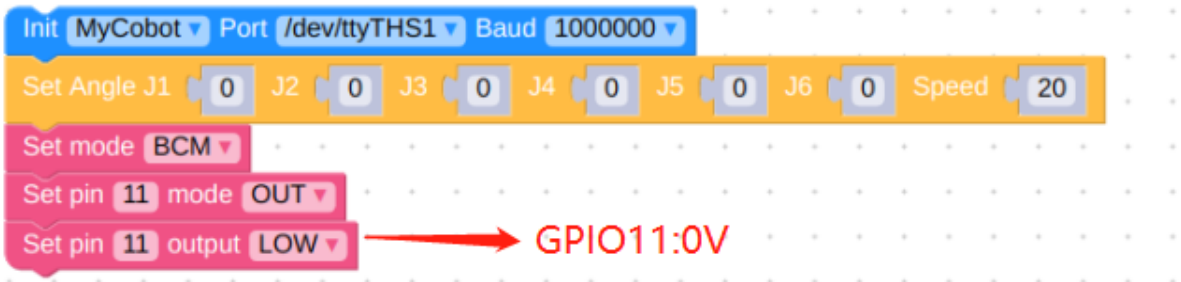
Please refer to Chapter 5 of gitbook or the following link:

https://drive.google.com/file/d/1XtKH-ykKWPH0q9Z_YHwzkgwNKRhstHhi/view?usp=sharing

Q: How to use the GPIO of mycobot260/270/280 series PI/JN machines?

A: Take 280JN as an example, please refer to the source code in the figure below. For other models, please change the device serial port information.





And be careful not to use occupied pins. For example, the occupied pins of 280JN are GPIO0, 1, 3, etc. For details, please refer to the GPIO description of the corresponding robot arm gitbook material

Note: When turning the robot arm, it should be turned at a small angle and gently. After reaching the limit, it cannot be turned forcefully.

Q: What is the role of atom in the robot arm?

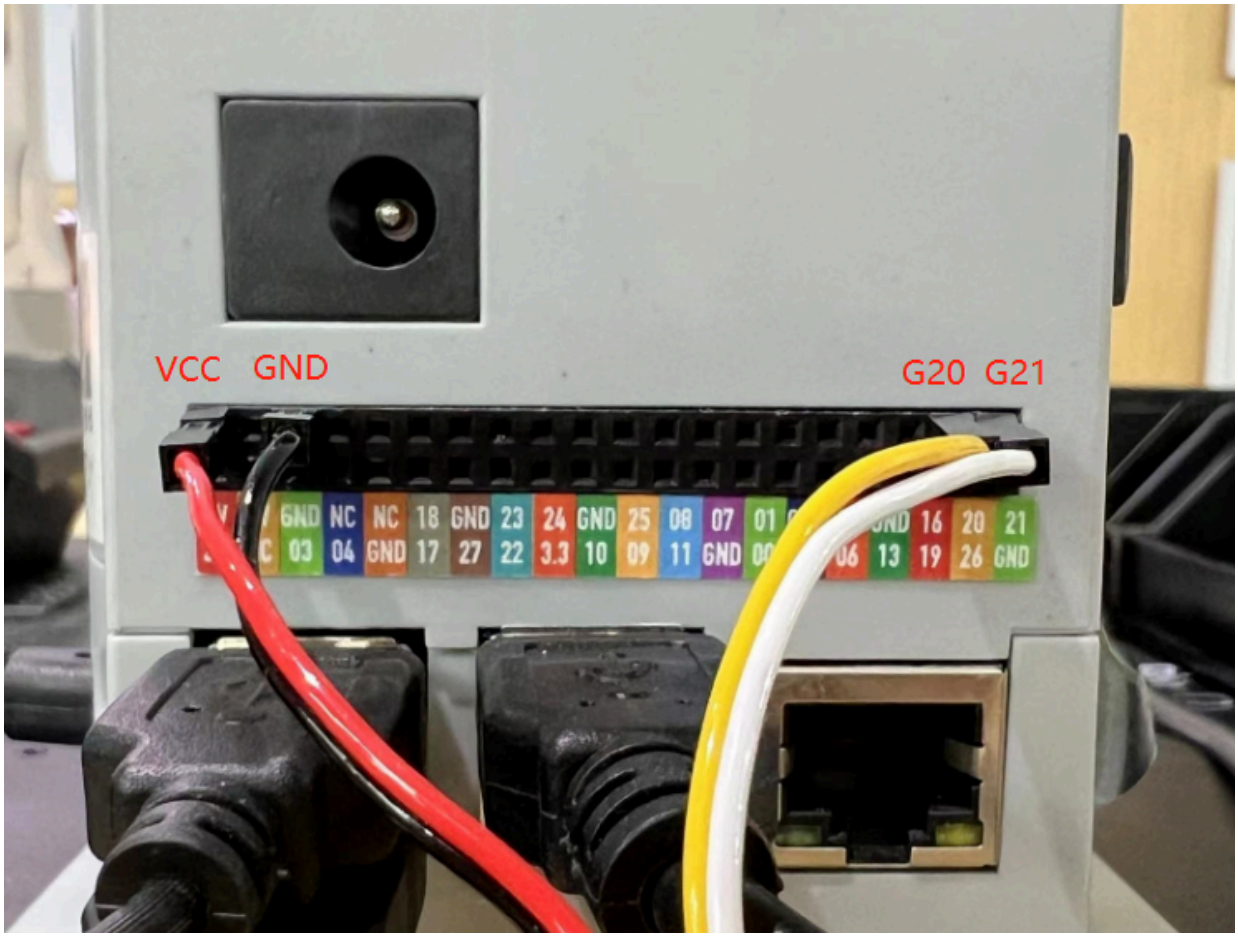
- A: Atom is mainly used in the robot arm to control the kinematic algorithm of the robot arm: including forward and inverse kinematics, solution selection, acceleration and deceleration, speed synchronization, multi-square interpolation, coordinate conversion, etc., and requires real-time control and multithreading. The relevant programs of atom are not open source yet.

Q: What communication interfaces do different versions of the robot arm support?

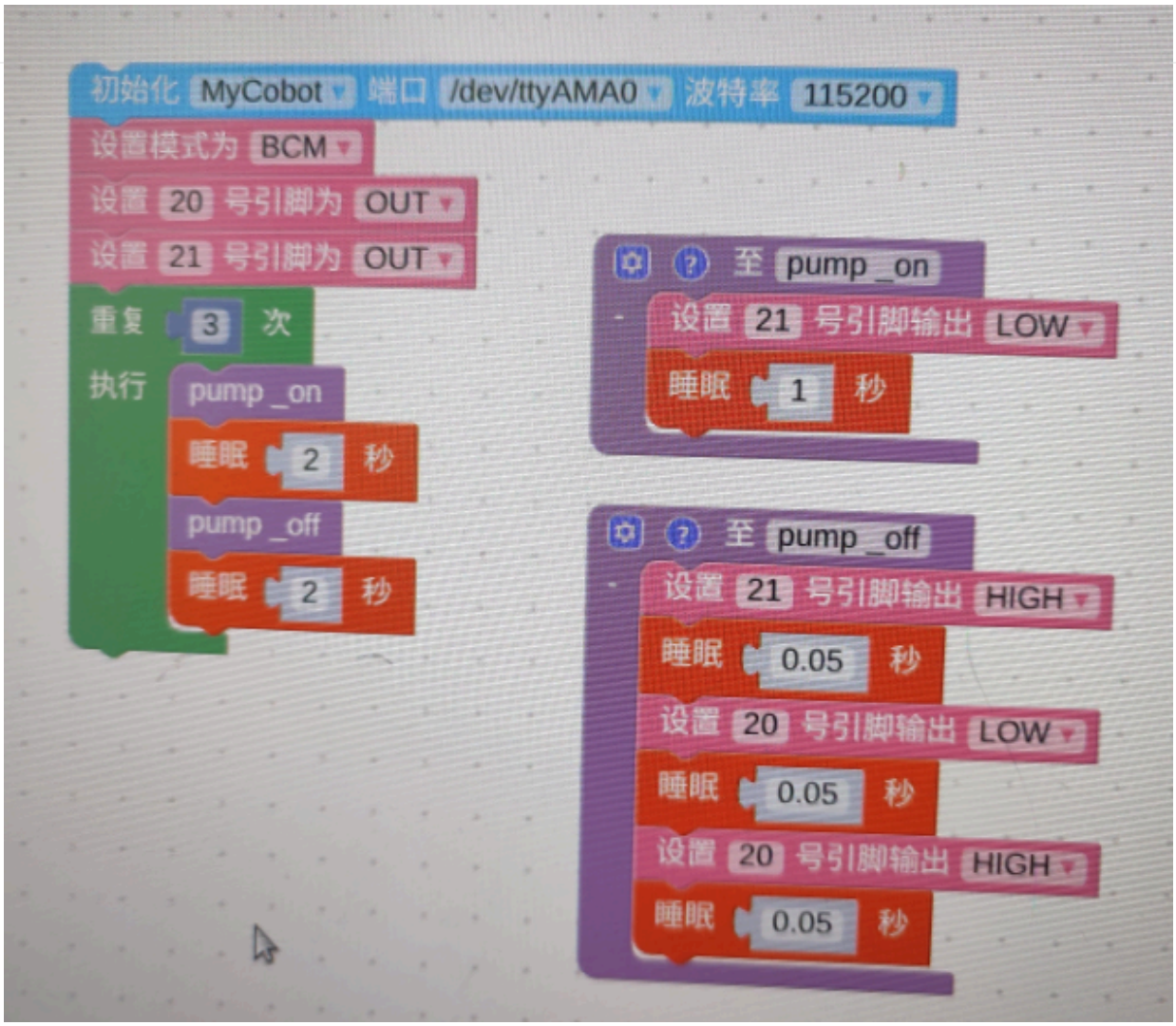
- A: The robot arm based on the microprocessor supports socket communication TCP; the robot arm based on the microcontroller can communicate via USB to serial port.

Accessory related questions

Q: 280pi and suction pump io connection diagram and quick use source code

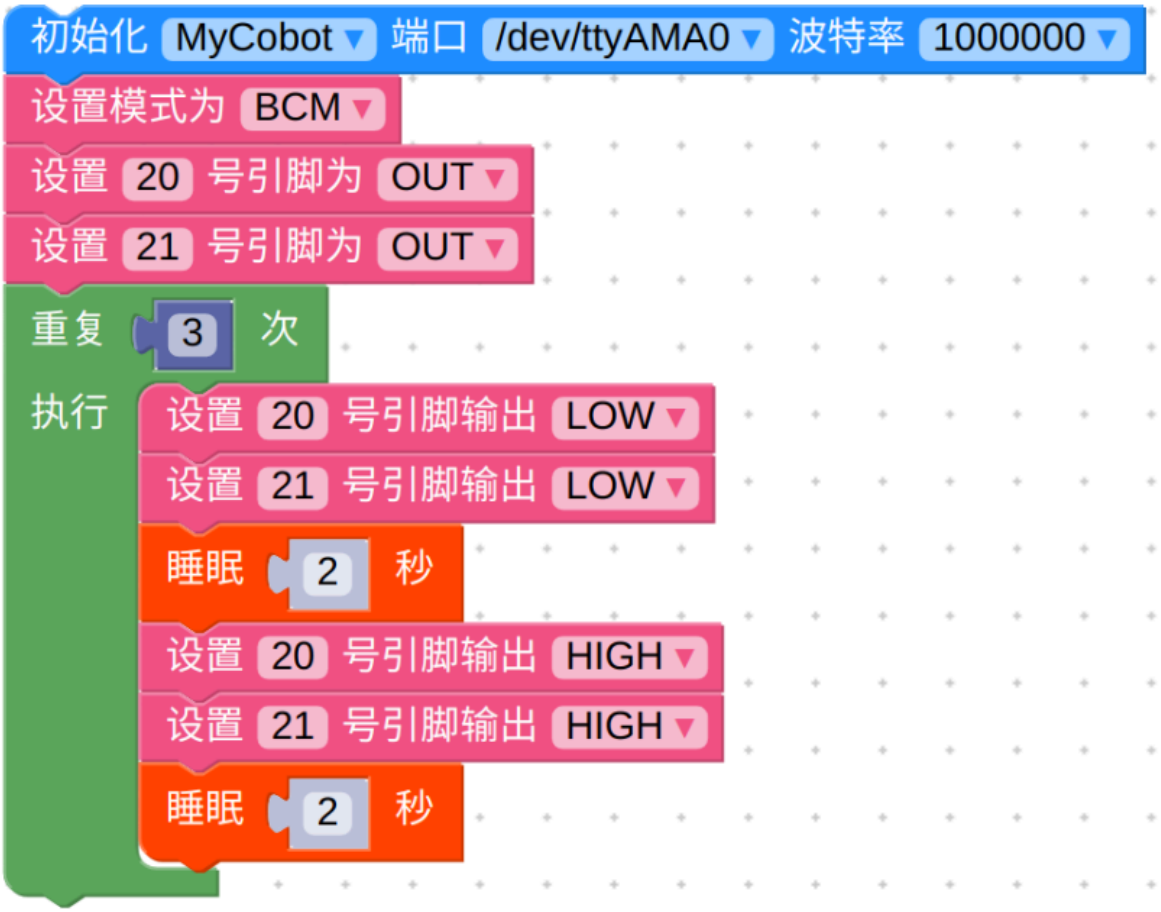


New version v2.0:

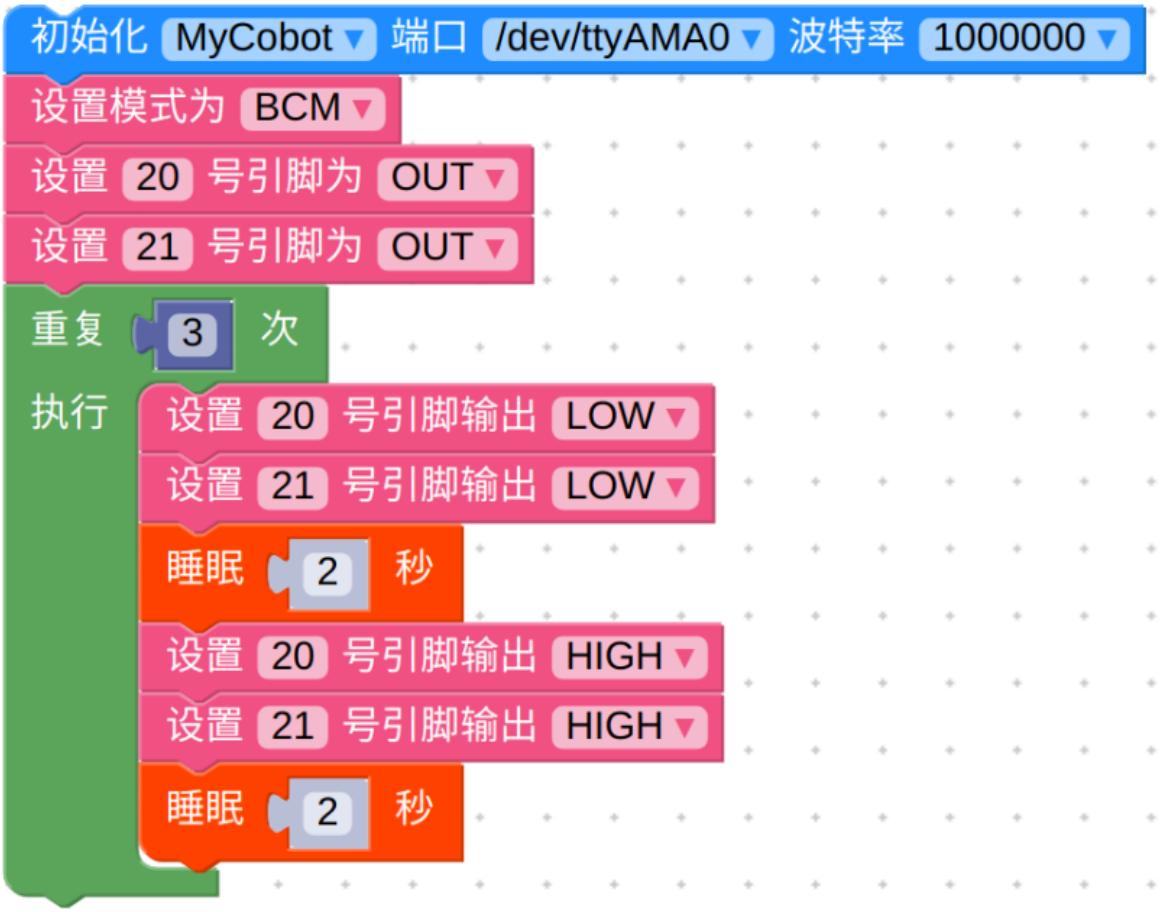


The G5 pin on the suction pump is the suction pump switch control pin, and the G2 label is the solenoid valve control pin. Both are low level valid. The function of the solenoid valve is to make the suction pump more rapid when released. If the solenoid valve is not used, the suction pump can also work normally, but the speed of releasing the object when the suction pump is closed is relatively slow. The source code here uses pin 21 to control the opening and closing of the suction pump, and pin 20 to control the opening and closing of the solenoid valve. The opening and closing of the solenoid valve mainly works in the stage of closing the suction pump.

Old version V1.0 version code:



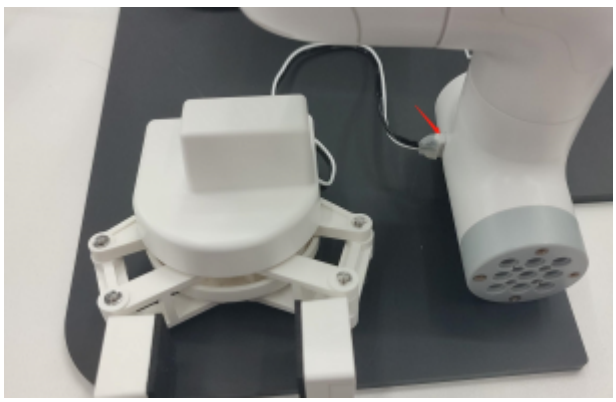
Q: Source code for 280pi using suction pump



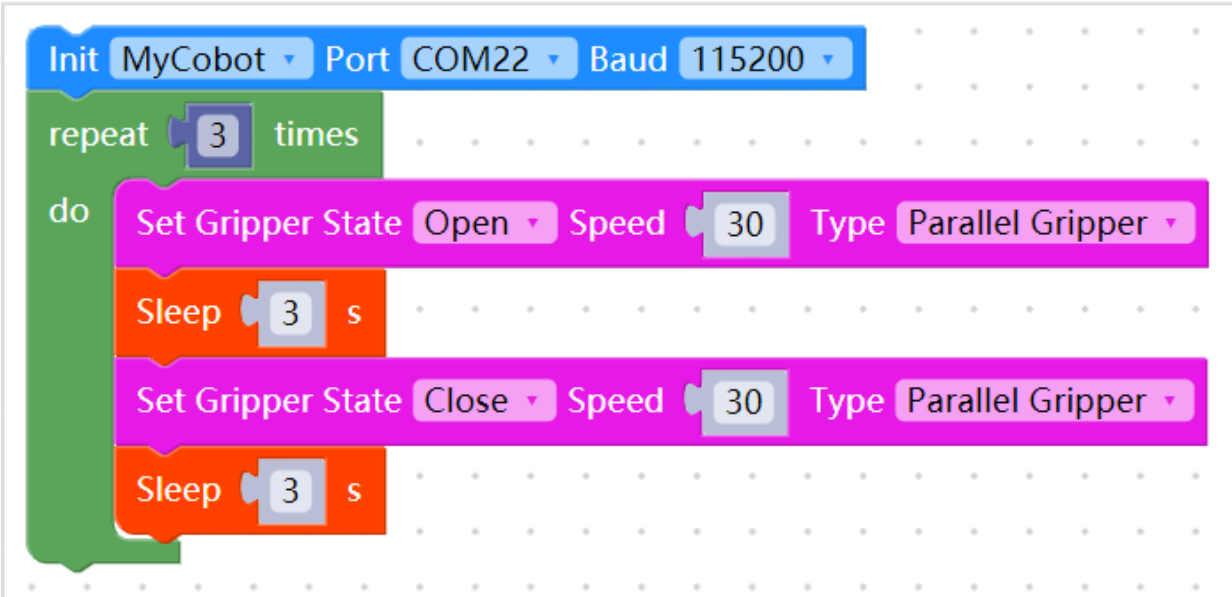
Q: What is the pin sequence and connection method of mycobot adaptive gripper?

Please refer to the following figure for the pin introduction of mycobot adaptive gripper:

Gripper connection method:



Q: Parallel gripper usage source code



Q: Is there anything to pay attention to between the gripping object and the movement of the robot arm?

When the load is > 500g, the speed needs to be less than 50%.

Other Issue

Q: How to completely turn off the hotspot auto-start function?

- A: If you want to completely turn off the hotspot auto-start function, you can move the hotspot_on.desktop folder in the ~/.config/autostart/ folder to another folder directory and restart the machine.

Q: Raspberry Pi or jetson nano mentions that a password is required. What is this password?

- A: You can try the following passwords:

```
Elephant
elephant
aibot1234
123
123456
123321
aaa
```

  If the above passwords are invalid, then the password should not be the password we set. You need to try to reset the system to reset the password. Please refer to Section 5 of the gitbook for the reset method.

Q：How to use the mycobot test tool?

A：The "mycobot test tool" is intended for factory use only, and we do not recommend users to use it. Using this tool may lead to abnormalities in the zero position or PID, resulting in damage to the robot. Please delete this tool directly. If you have already used this tool and it has caused abnormal movement of the robot, please refer to the following instructions to readjust the PID and zero position. Furthermore, refrain from continuing to use this factory test tool in future operations. Resetting PID method reference link: https://drive.google.com/file/d/1UWhaaSTuwLFImuEGY1J2tvgxTQDwWxK_/view?usp=sharing Zero position calibration method reference link: https://drive.google.com/file/d/1XtKH-ykKWPH0q9Z_YHwzkgwNKRhstHhi/view?usp=sharing

Q: How to reset to factory settings when the machine is abnormal?

Restoring to factory settings mainly depends on resetting the firmware, image, pid and zero position. The following is the reset solution:

- **About resetting the firmware**: It is recommended to ensure that mystudio is updated to the latest version, and then download the corresponding latest Atom version firmware, minirobot firmware (only available in M5 series machines) and pico firmware (only available in 320 series models). For the method of resetting the firmware, please refer to the mystudio chapter of gitbook
- **About resetting the image**: When resetting the image, all contents in the original system will be cleared. If there are important files, please save them in advance. For the method of resetting the image, please refer to the system usage chapter of gitbook
- **About resetting pid**: Generally, when the machine has severe joint shaking, abnormal joint movement speed, and joints curled up, the pid can be reset. For the reset method, refer to: https://drive.google.com/file/d/1UWhaaSTuwLFImuEGY1J2tvgxTQDwWxK_/view?usp=sharing
- **About resetting zero position**: Generally, when the machine has an incorrect zero position or the joint limit is abnormal, the zero position can be recalibrated. For the reset method, refer to: https://drive.google.com/file/d/1XtKH-ykKWPH0q9Z_YHwzkgwNKRhstHhi/view?usp=sharing

Q: Why can't I see the corresponding Raspberry Pi or Jetson Nano system interface when I connect the Raspberry Pi or Jetson Nano to my PC using an HDMI cable or USB?

- A: Since the Raspberry Pi series machines are devices with their own factory systems, which are equivalent to a microcomputer, when two computers are connected via HDMI or USB, only the system interface of the current computer will be displayed, and the Raspberry Pi system interface will not be displayed. This is normal. Regarding how to correctly enter the Raspberry Pi system, you need to prepare an HDMI screen and connect the HDMI screen to the HDMI interface of the Raspberry Pi via an HDMI cable so that you can see the Raspberry Pi system interface. If you want to remotely control the Raspberry Pi on your computer later, this is also feasible. You can check the VNC remote tool. For specific usage methods, please refer to the gitbook system usage information.

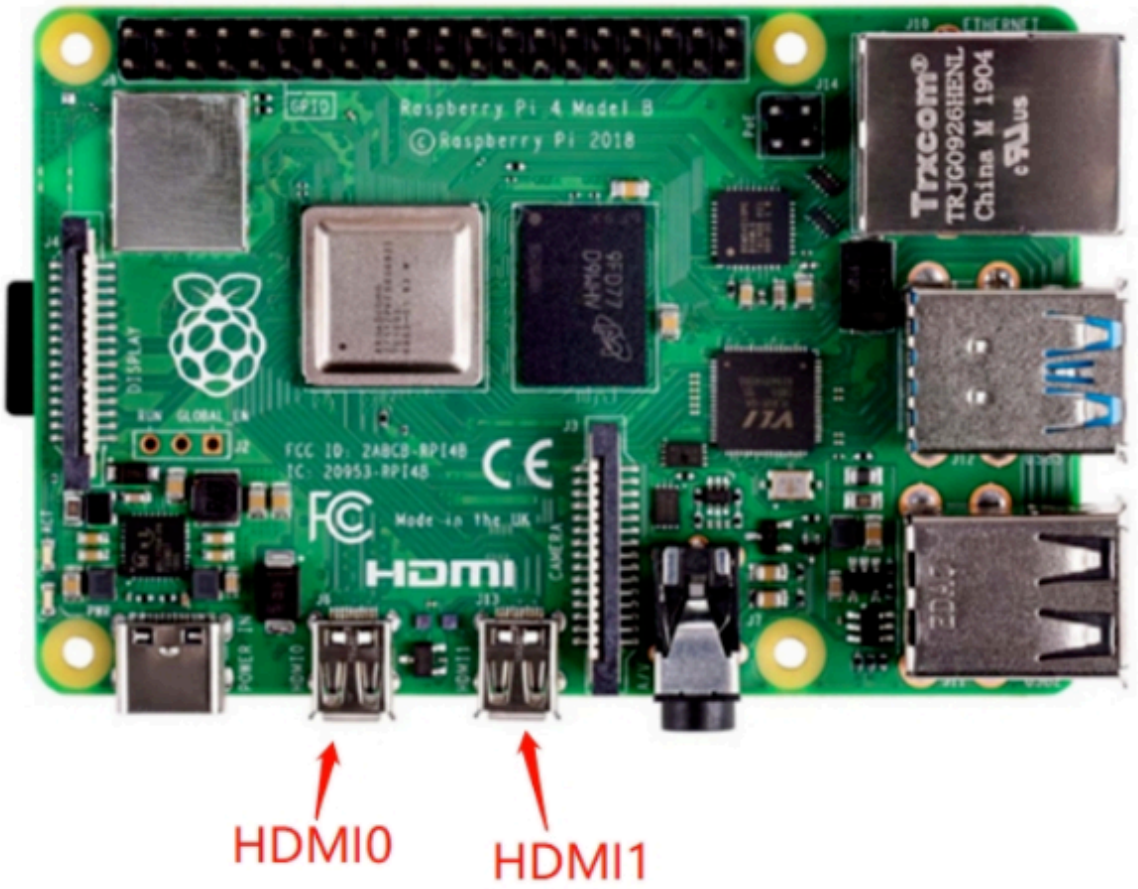
Q: Where is the download path for the urdf file?

- A: Please refer to the following path. The urdf of all mycobot models is in this path: https://github.com/elephantrobotics/mycobot_ros/tree/noetic/mycobot_description/urdf

Q: What should I do if the Raspberry Pi cannot boot into the system?

- A: Please follow the steps below to check:
- Check whether the HDMI interface cable is loose. It is recommended to straighten the HDMI cable. The bending state will affect the signal transmission.

1. Try to replace an HDMI cable or HDMI interface test (there are two HDMI ports on the Raspberry Pi 4b, HDMI0 and HDMI1.

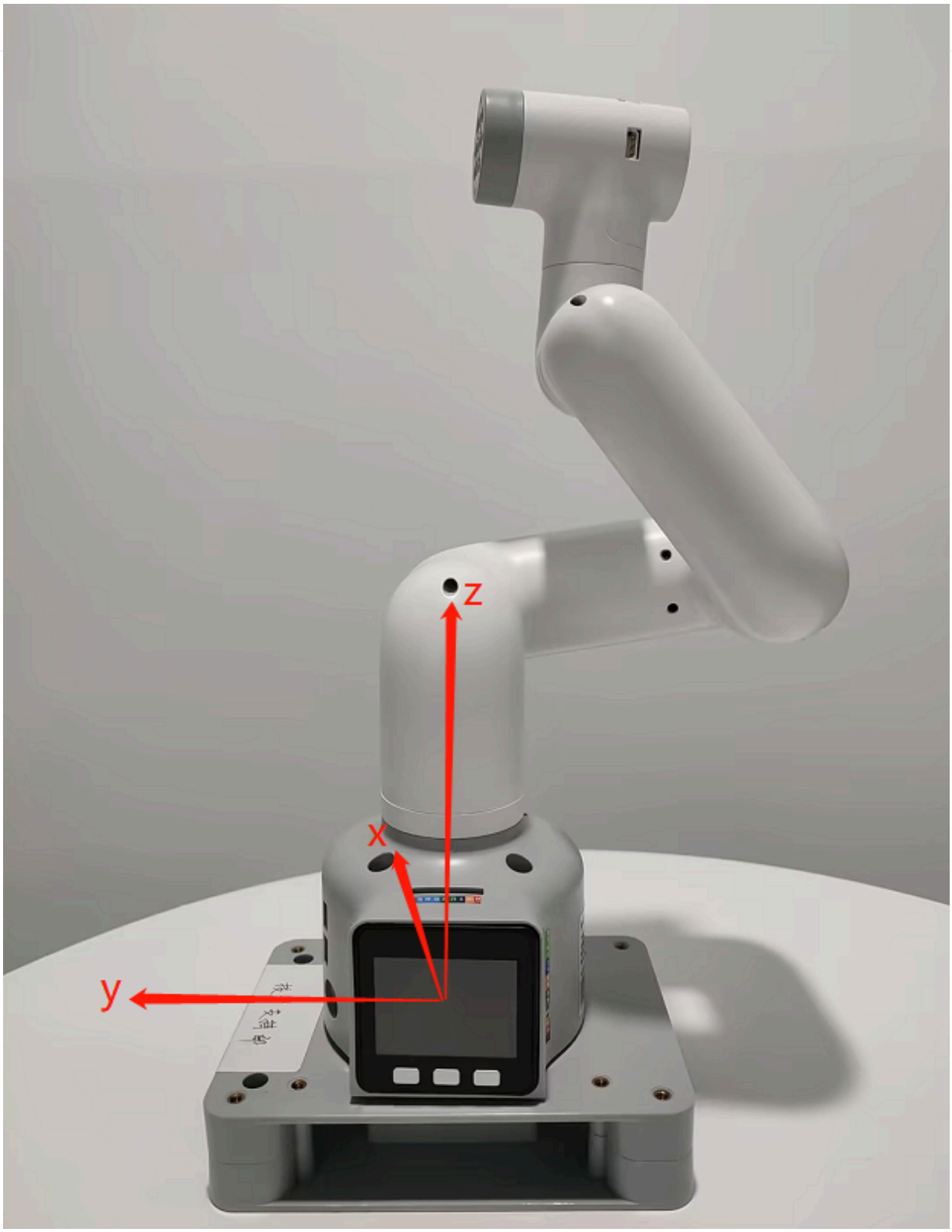


1. Confirm whether it is an HDMI screen (1080p is recommended). The VGA screen will be incompatible and sometimes cannot display the Raspberry Pi screen. It is recommended to try to replace an HDMI screen to test whether there is a screen display.
2. Complete the HDMI wiring first, and then restart the machine several times. The restart interval and boot waiting time are recommended to be 3-5 minutes
3. Check Chapter 5 of gitbook and re-flash the corresponding image file.
4. If the robot still cannot boot after burning the image, if you have an Ethernet cable and a router, please connect the Ethernet cable to the network port of the Raspberry Pi while the robot is turned on, log in to the router to see if there is a Raspberry Pi device IP. If there is no Raspberry Pi IP, then the Raspberry Pi is damaged.

Q: How long is the command transmission delay when controlling the motor through the robot's controller via serial port or socket communication? Is there a communication timing diagram? How about real-time performance?

There is no delay test data for serial or socket communication. According to the feedback from our development and use, the real-time performance is still quite high and there will be no lag.

Q: What is the base coordinate system of the 280M5 robot?



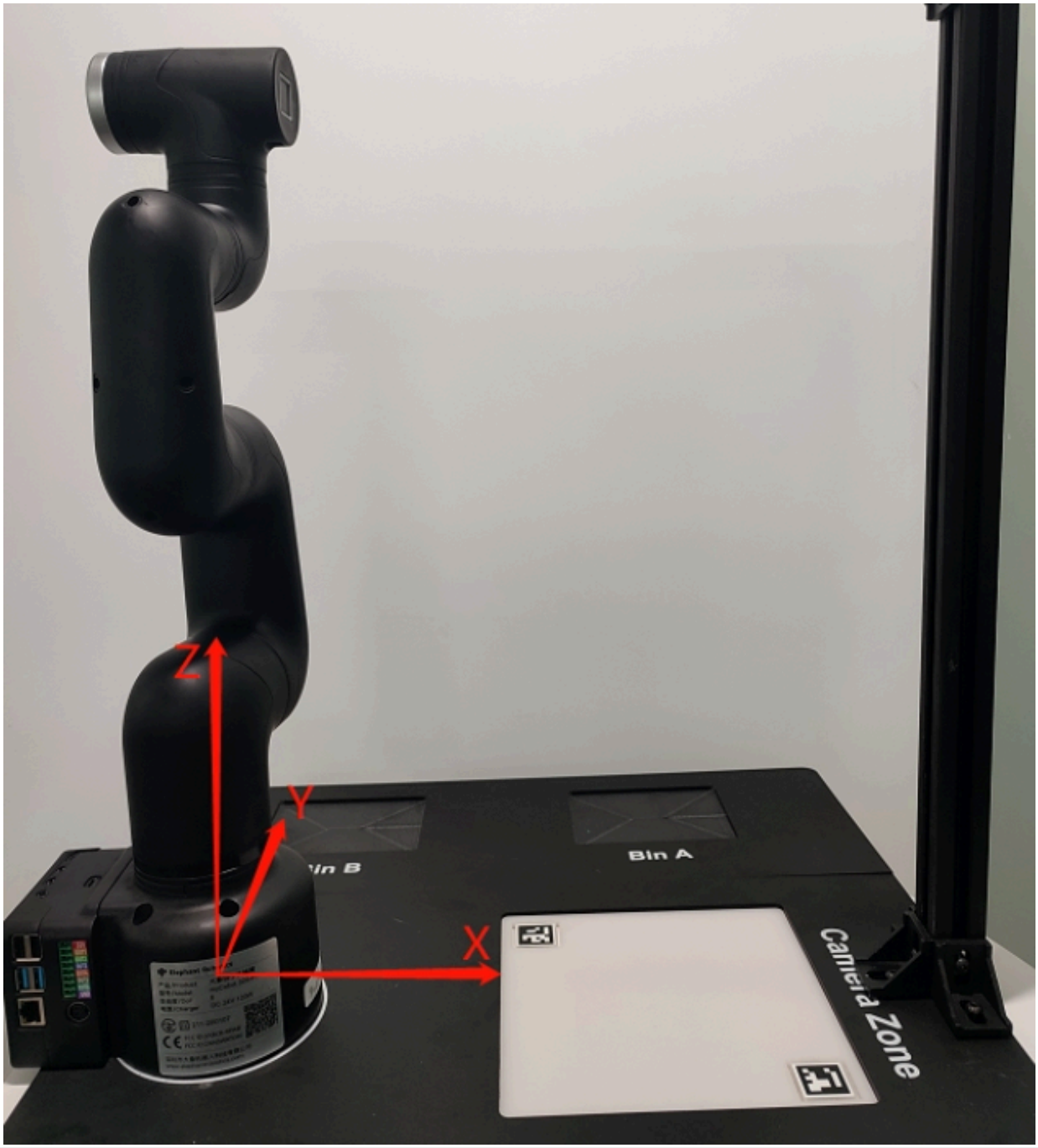
Q: Are the joints of 280 controlled by the serial bus?

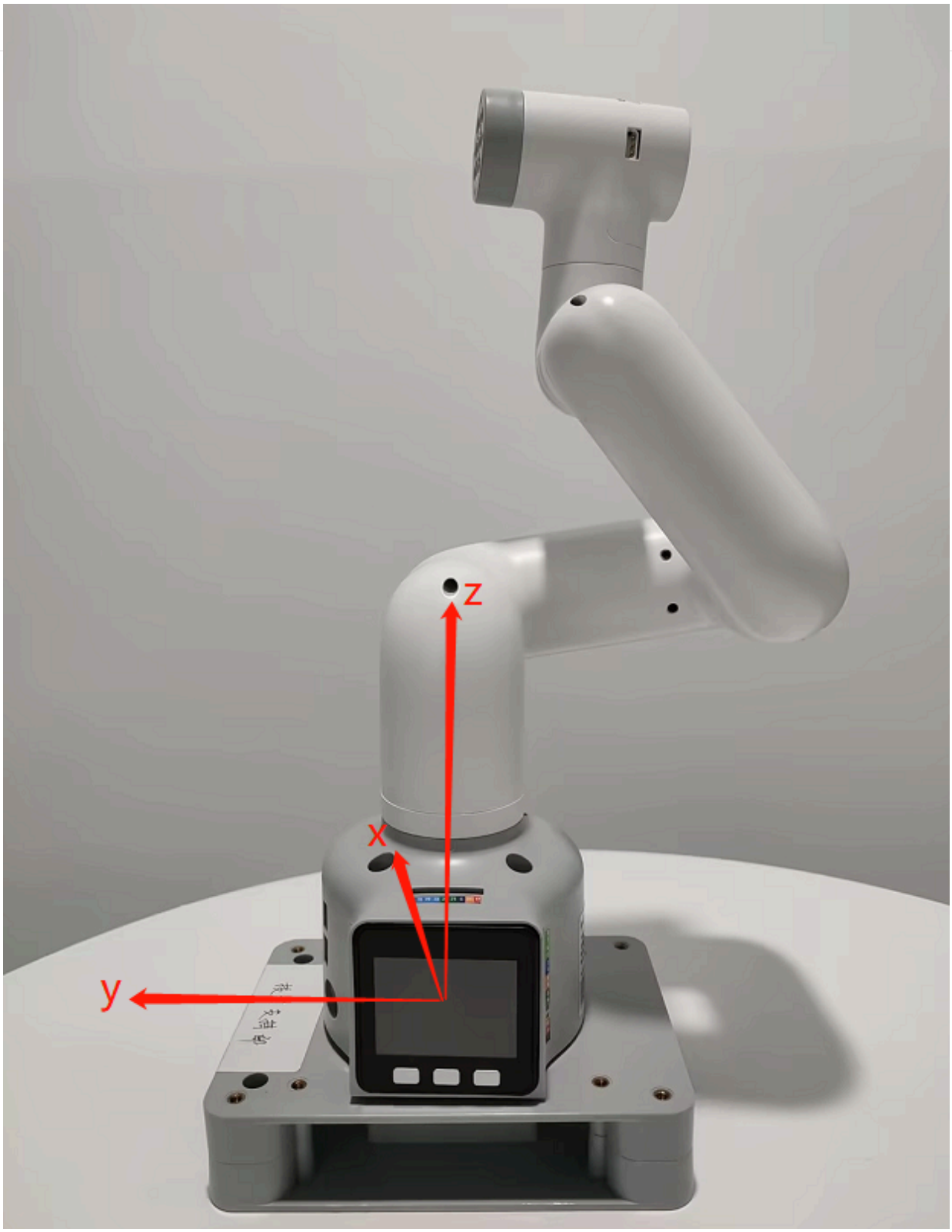
A: Yes

Q: Is there more explanation about the understanding of coordinates?

A: The API for controlling coordinate movement is send_coords([x,y,z,rx,ry,rz], speed) **x, y, z coordinates:** Control the position of the end effector of the robot in space. Changing these coordinate values will move the robot to different spatial positions, thereby achieving positioning in three-dimensional space. **rx, ry, rz attitude angles:**

Control the attitude or orientation of the end effector of the robot. These values are usually given in the form of Euler angles, describing the rotation of the end effector of the robot relative to the base coordinate system, and the order of Euler angles is zyx. Changing these values will rotate the end effector of the robot to different angles or directions. For example: When you adjust +X, this means that the position of the end effector of the current robot arm moves a certain distance along the positive direction of the X axis of the current end effector. This action will cause the robot to move in a certain direction as a whole. And when you adjust RX, this means that the attitude of the end effector of the current robot arm rotates a certain angle around the X axis of the current end effector. This action will cause the robot to rotate as a whole and the direction of the end effector will change. In general, the adjustment of +X and RX will directly affect the motion state of the robot arm. +X controls the movement of the position, while RX controls the change of attitude. If you want to see the changes more intuitively, we recommend that you use myblockly's serial control tool to adjust a parameter at a time and observe its changes in the coordinate system. Please note that when observing rx, ry, and rz, if you want to be more intuitive, please pay attention to adjusting x and ry when the J1 joint is 0, and adjusting y and rx when the joint is 90. You can refer to the coordinate system diagram below:





Q: Which group or urdf does the 280JN-aikit have with the trash bin?

- A: Currently, only the PI version has the urdf with the package content, and other machines do not. For the path of the PI version, please refer to the figure below

mycobot_ros / mycobot_description / urdf / mycobot_pi / mycobot_with_vision_v2.urdf

Q: How to solve the problem of using vscode on the Raspberry Pi?

- A: Reference link: https://blog.csdn.net/u011296285/article/details/121121118 Reference link (En): https://ratticon.com/how-to-fix-slow-visual-studio-code-on-raspberry-pi-4/

Q: How to use the serial port protocol of the PI/JN series robot arm?

- A: In the python code, you can directly send serial port commands to control the joints, without external devices

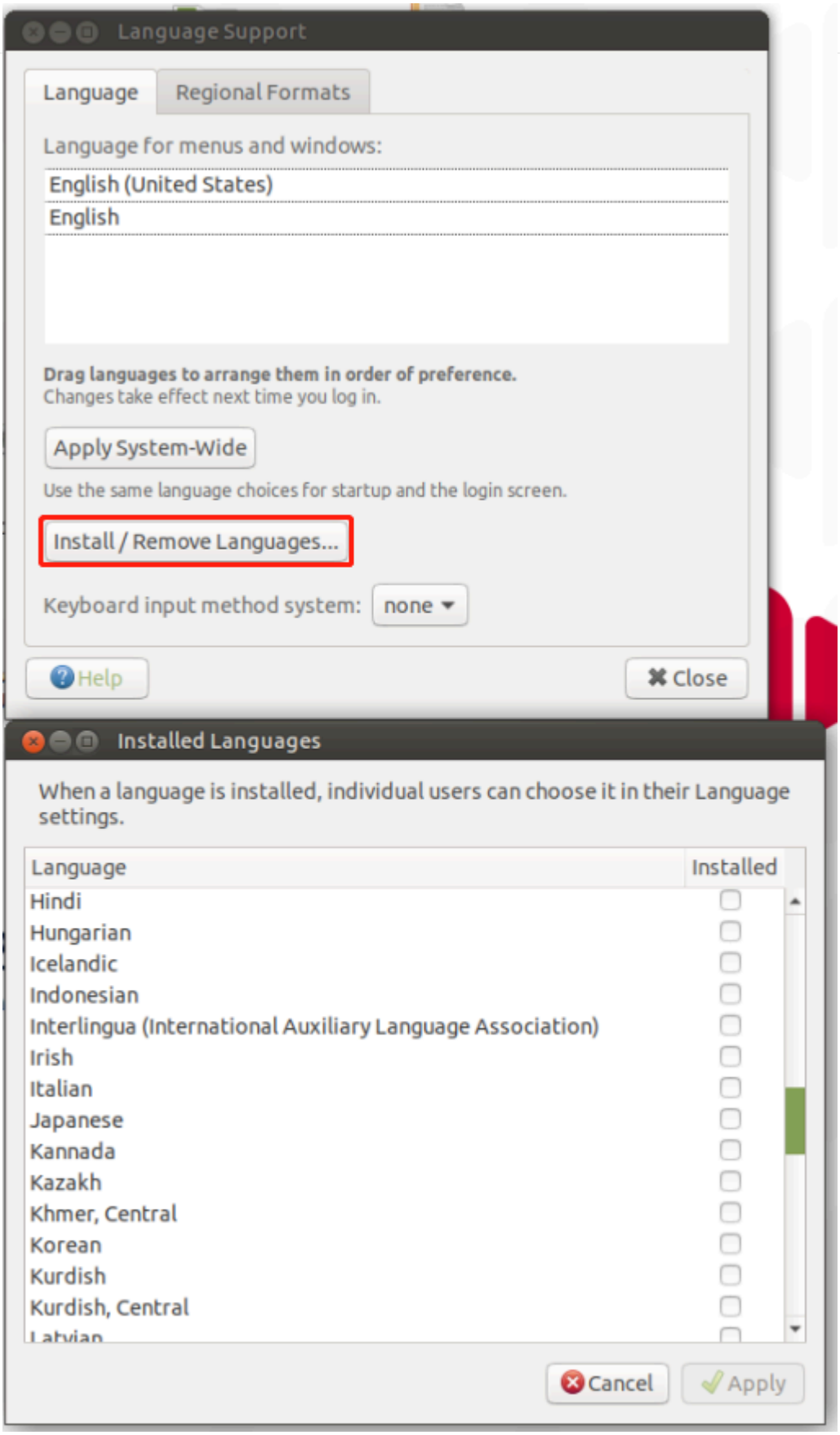
```
from pymycobot import MyCobot280
import serial
import time

ser=serial.Serial("/dev/ttyTHS1", 1000000)

command1=bytes.fromhex('FE FE 06 21 01 23 28 14 FA')#J1:90
command2=bytes.fromhex('FE FE 06 21 01 00 00 14 FA')#J1:0

ser.write(command1)
time.sleep(3)
ser.write(command2)
ser.close()
```

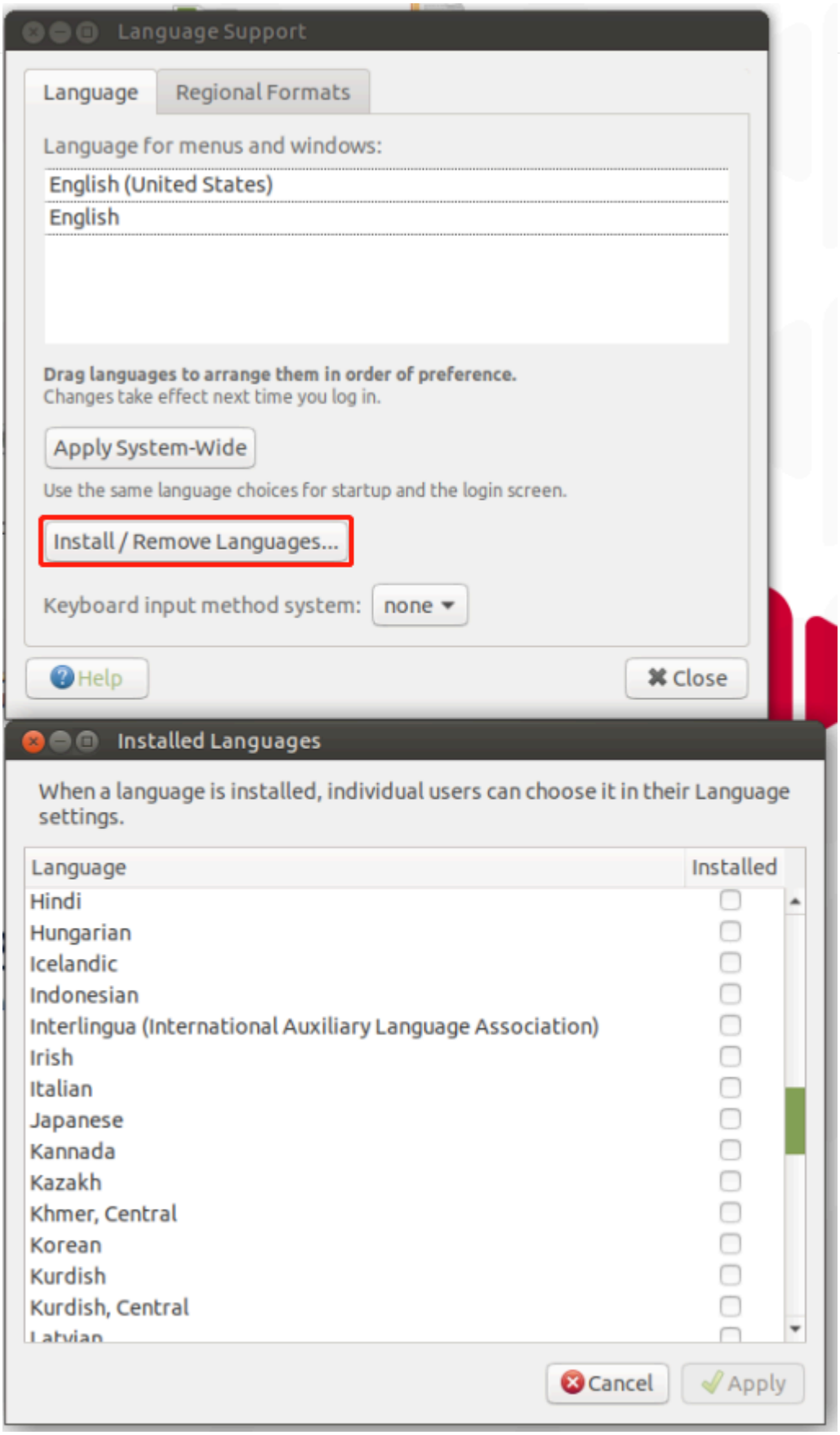
Q: Is there more explanation about the Offset of the DH parameter? Is the Offset rotated around z?

A: The DH parameter describes the geometric and kinematic relationship between adjacent links in the robot arm. In the DH parameter table, the Offset parameter indicates the effect of the previous link rotating around its z-axis on the position of the next link, that is, the offset when connecting two links. For the Offset parameter in the robot arm, it generally indicates the effect of the previous link rotating around its own z-axis on the position of the next link, rather than rotating around the z-axis of the next link. Therefore, Offset is not a rotation around z, but a displacement when connecting two links.

Q: Can the system add other languages, such as Korean?

A: Yes, just download the language installation package and apply it


Language Support
Language
Regional Formats
Language for menus and windows:
English (United States)
English
Drag languages to arrange them in order of preference.
Changes take effect next time you log in.
Apply System-Wide
Use the same language choices for startup and the login screen.
Install / Remove Languages...
Keyboard input method system:
none
Help
Close
Installed Languages
When a language is installed, individual users can choose it in their Language settings.
Language
Installed
Hindi
Hungarian
Icelandic
Indonesian
Interlingua (International Auxiliary Language Association)
Irish
Italian
Japanese
Kannada
Kazakh
Khmer, Central
Korean
Kurdish
Kurdish, Central
Latvian
Cancel
Apply



Q: Can mind+ be used to control the robot arm?

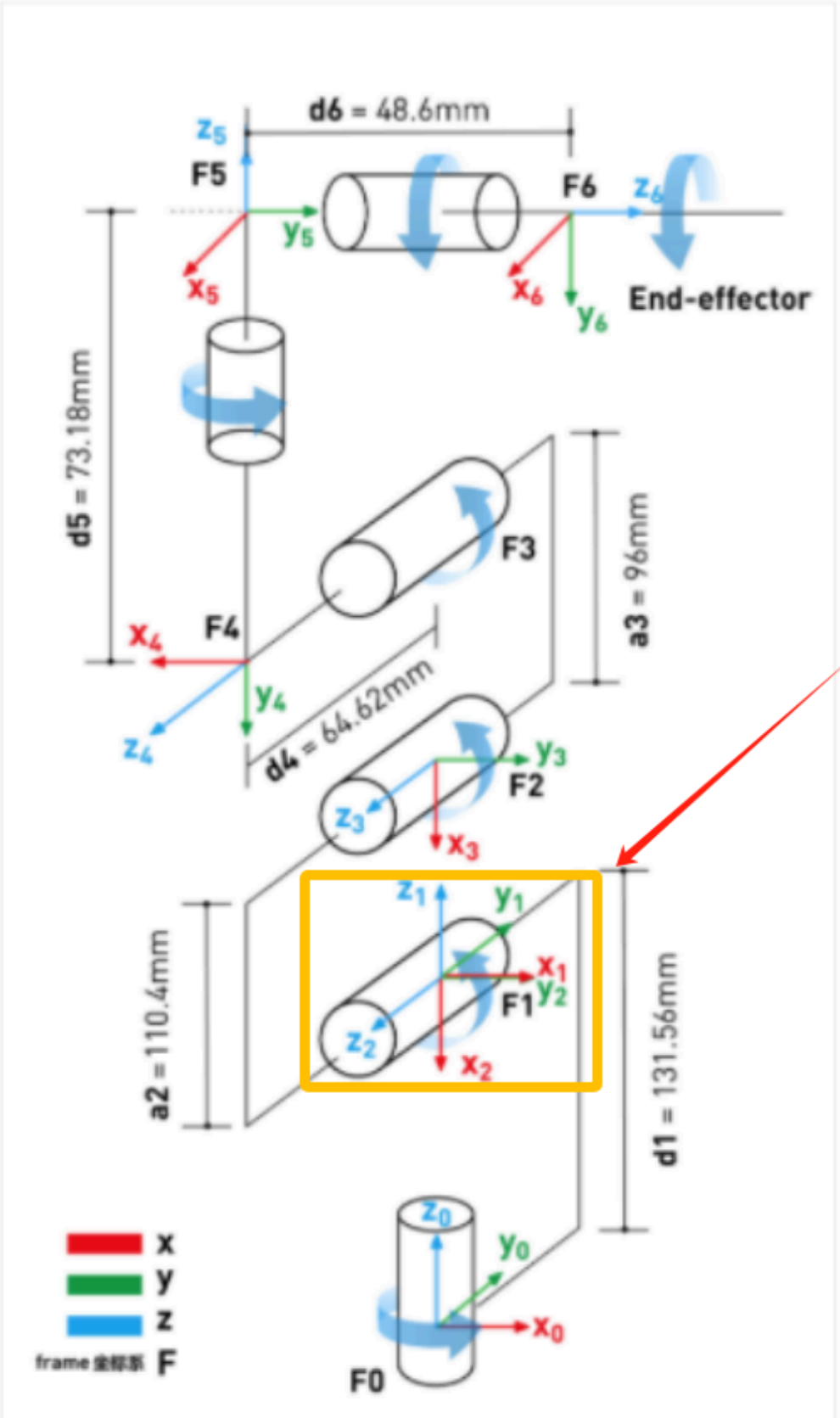
A: No, mind+ is not currently compatible, so it cannot be used to control the robot arm. The currently recommended methods for controlling the robot arm are myblockly, python and ros. If you want to use graphical programming, myblockly can meet your needs

Q: What is the voltage range of the 280 robot arm power supply? How much is the instantaneous current?
A: 12V plus or minus 10%, 5A

Q: What is the inner diameter of the J1 joint of the 280M5? A: 70mm

Q: Why are two coordinate systems defined at F1 in this DH model of the 280m5?

3 DH参数


d6 = 48.6mm
z5
F5
y5
x5
F6
z6
x6
y6
End-effector
d5 = 73.18mm
F3
a3 = 96mm
x4
F4
y4
z4
d4 = 64.62mm
y3
F2
z3
x3
z1
y1
x1
y2
F1
z2
x2
a2 = 110.4mm
d1 = 131.56mm
z0
y0
x0
F0
x
y
z
frame 坐标系 F

Q: Following the above question, why are the physical distances of axis 1-2 different, but the origin settings are overlapping?

A: Because the rotation axes intersect, DH modeling has regulations. If the rotation axes of adjacent joints intersect, the origin must be set at the intersection

Q: If the servos of each axis are controlled and feedback is obtained, what is the shortest communication cycle?

A: This needs to be determined according to the speed. The minimum response time is 50ms

Q: Does the mycobot series machine have collision detection?

A: 280 has algorithmic collision self-interference, which has been integrated into the API for setting joint angles and coordinates

Q: What are the input parameters of Atom's USB interface?

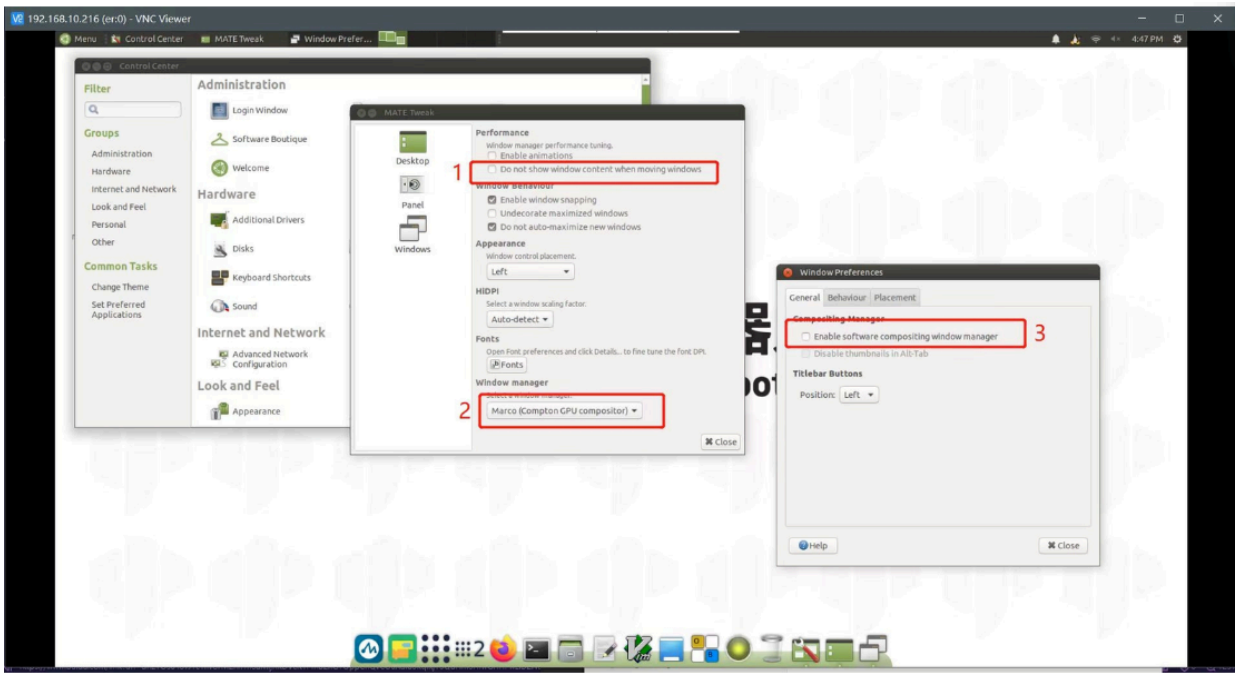
A: 5V @ 500mA

Q: How to deal with the 270 j3 joint not being able to display joint values in real time?

A: Reference link: https://drive.google.com/drive/folders/1BrvMxJltcLsr8T8-4kKOB7SH0D_qZkIP?usp=sharing The corresponding firmware has been replaced, and the corresponding python file can be run directly

Q: How to deal with the VNC dragging jam?

A: If the jam is caused by dragging any window in VNC, you can make some configurations according to the picture below. The options need to be consistent with the picture below. After successful setting, the problem of VNC disconnection caused by dragging the window will be solved.



Q: When replacing the second joint of 280, I found that 4 screws were stripped. How to remove them?

Regarding the replacement of joints, the 4 screws do not need to be removed. Please remove the large screw in the middle, then fix the J2 joint body back, and then use force to pull out the entire coupling. I recorded a video for you to refer to for specific operations

Q: Is the joint torque information provided?

A: Our machines only provide the overall information of the entire joint, and do not provide the internal torque, voltage and current of the servo and motor actuator. The overall parameters of the robot arm are disclosed, such as repeatability, power supply voltage, etc.

Q: How do you understand the relationship between the two coordinates in the following figure?

- **查看两个坐标系之间的关系**

```
ros2 run tf2_ros tf2_echo [reference_frame] [target_frame]
ros2 run tf2_ros tf2_echo turtle2 turtle1
```

A: If you want to view the transformation relationship between the coordinate system named "turtle1" and the coordinate system named "turtle2", you can use this command. In layman's terms, when you run this command, it will tell you the position and direction information of an object ("turtle1") relative to another object ("turtle2"). Just like you can know the position of a city relative to another city on a map

Q: The environment of ROS2 has been accidentally changed. Can I just delete the 280pi ROS and reinstall it myself? A: Regarding the issue of reinstalling ROS, we do not recommend users to reinstall it themselves, because the construction of the ROS environment is relatively complex and prone to errors. If you need to reset the ROS environment, we recommend users to re-write the system image. For specific methods, please refer to Development and Use Based on ROS

Q: How to solve the problem of excessive repeated positioning deviation after the robot arm is in place at the same position?

Both new and old machines can adjust pid to reduce deviation as much as possible.

Appendix: https://docs.qq.com/doc/DU0VhT2JNVUdNUEJS, https://drive.google.com/file/d/1UWhaaSTuwLFImuEGY1J2tvgxTQDwWxK_/view?usp=sharing However, the old version of the machine has gear gaps in the 2nd and 4th joints of the robot arm, which is easy to produce joint deviations under the action of gravity, which ultimately affects the end precision. The forces of the 2nd and 4th joints in these four sets of joint values are inconsistent, so the precision is also different. It is currently recommended to adjust through the program. When the machine reaches the point, you can read the point again at this point to check if there is a deviation. On this basis, adjust the specific deviation value of the single joint to achieve the effect of reaching the specified point.

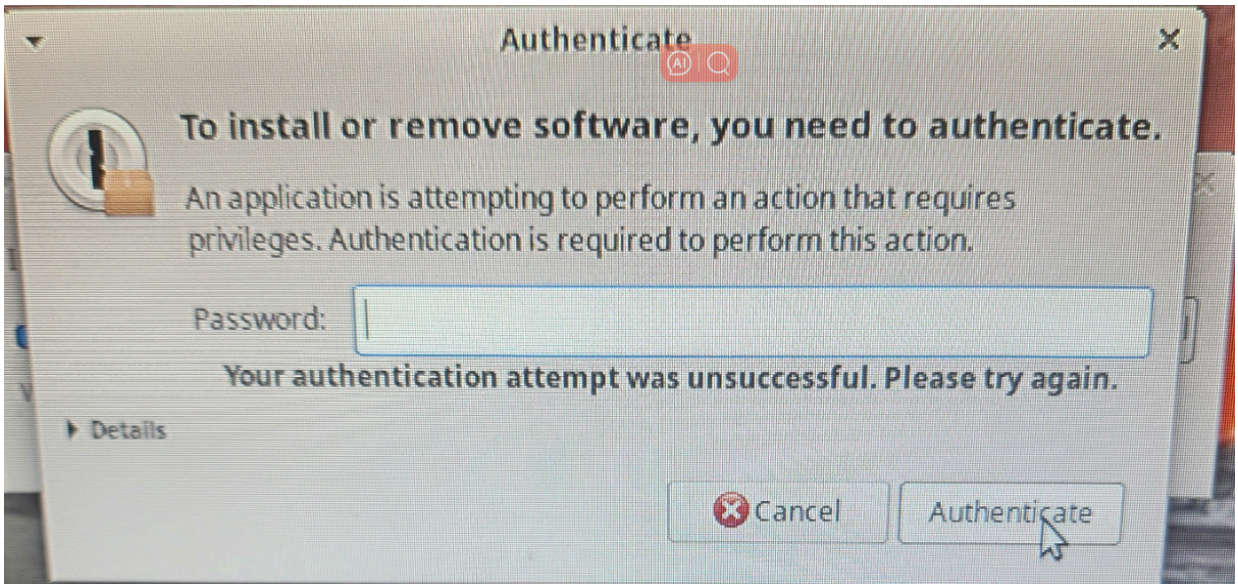
Q: What is the difference between API and serial port instructions to directly control joints?

A:

1. Serial port instructions:
    - a. Serial port instructions are sent to the robot controller in the form of raw binary data.
    - b. It is usually necessary to manually encode the parameters such as the angle, speed, acceleration, etc. of each joint, and then convert them into hexadecimal form for sending.
    - c. It is necessary to understand the format and meaning of each instruction and ensure that it is sent to the controller correctly.
    - d. Sending serial port instructions directly is more flexible, but also more complicated, and requires a deep understanding of the communication protocol of the robot controller.
2. API control:

- a. API provides an advanced function interface that can more conveniently control the movement of the robot.
- b. There is no need to manually encode binary instructions, but to call the API function and pass the required parameters to the function.
- c. API usually hides the underlying communication details, provides a simpler and easier-to-use interface, and reduces the complexity of use.
- d. Usually provides a variety of convenient functions, such as path planning, motion interpolation, etc., making control more flexible and efficient. In general: Using serial port commands to directly control the robot arm is more flexible, but also more complex, requiring a deep understanding of the communication protocol; while using API control is simpler and more convenient, but may be limited by the functions and performance provided by the API.

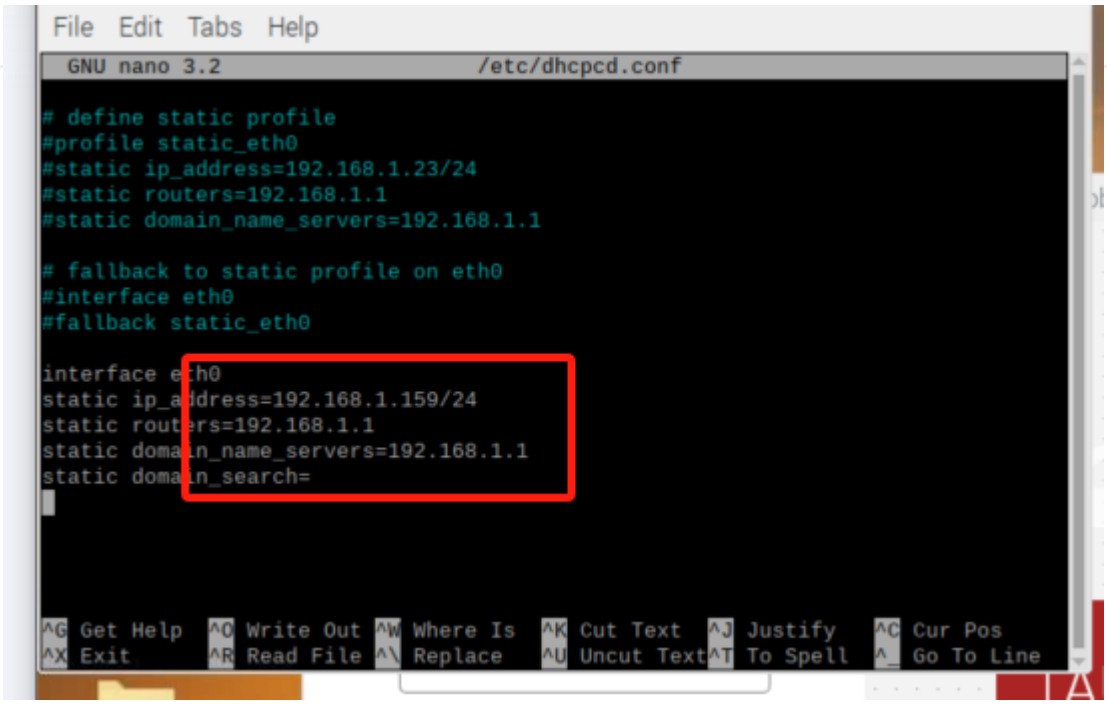
Q: When I click to open a program or application, a password is prompted. What is this password?



A: Password: aibot1234

Q: How to fix the IP of the pi robot?

A: Fix the IP: Use the terminal to input: sudo nano /etc/dhcpcd.conf



Then you can configure the network information yourself.

Q: What is the difference between MDI and JOG?

A: MDI (Manual Data Input) is called the set value direct given operation mode. That is, after the upper controller directly sets the target position, speed, acceleration and deceleration, the axis automatically moves to the target position. MDI is also the most commonly used positioning function in practical applications. JOG moves continuously in a certain direction.

Q: What is the latest supported version of pymycobot for each model?

机型	最新支持版本
260	3.9.7
270	
280	
320	
myAVG	
myArm	
myArm M&C	
UltraArm	
630-pico	
水星6轴	一层闭环(不支持头部两个舵机)：3.5.0dev5 无闭环(不支持头部两个舵机)：3.5.0dev6 完整闭环：3.5.0dev15 一层闭环(支持头部两个舵机)：3.5.0dev8（待测试，未发布，可以找开发要）
水星7轴	无闭环：3.5.0b19 一层闭环（到位指令为0）：3.5.0b14 完整闭环：3.9.7

Q: How to distinguish between standard and improved DH tables

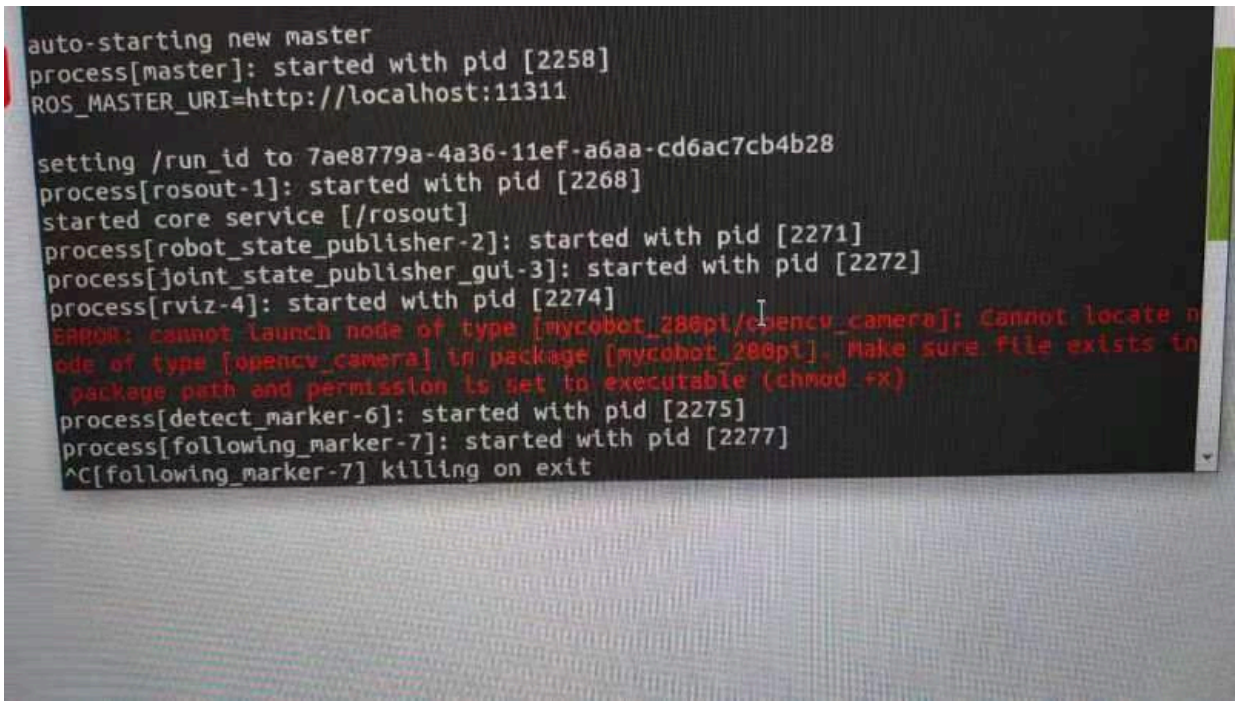
sdh, std, standard mdh, modify, improved We provide standard DH tables. Customers can convert them by themselves if necessary. They are just two different description methods.

SDH参数表

mycobot280:: 6 axis, RRRRRR, stdDH, slowRNE

j	theta	d	a	alpha	offset
1	q1	131.22	0	1.5708	0
2	q2	0	-110.4	0	-1.5708
3	q3	0	-96	0	0
4	q4	63.4	0	1.5708	-1.5708
5	q5	75.05	0	-1.5708	1.5708
6	q6	45.6	0	0	0

Q: How to deal with the error of missing opencv_camera?



A: The error message shows that the executable permission is missing. You may need to add the permission.

Change to using mycobot_280 instead of pi itself, because the m5 side has occupied the file. Both sides cannot occupy it at the same time, otherwise it will cause the subsequent compilation to fail.

Q: The indicator light of the adapter is not on

A: It is possible that the adapter is powered off for self-protection after a short circuit. Disconnect the adapter for a few minutes before using it. If it does not work after a few minutes, wait a little longer. After 15 minutes, power on the adapter separately to see if it lights up.

Q: End zero position abnormality

A: After using the adaptive gripper to grip objects for a long time, the gripper and end zero position abnormality will occur, and the gripper needs to be stationary.

Q: What is forward kinematics and inverse kinematics?

A: Forward kinematics refers to solving the position and posture of the robot's end effector (such as the gripper of the robot arm) in Cartesian space when the angles (or displacements) of each joint of the robot are known. It is implemented in the get_coords() API, but the specific algorithm is not public. Inverse kinematics is the opposite of forward kinematics. It refers to solving the angles (or displacements) of each joint of the robot when the position and posture of the robot's end effector in Cartesian space are known. write_coords(), send_coords()

Chapter 5 Basic Functions

This chapter mainly explains the basic functions and usage of the product and the use of basic software. This chapter is very important and should be read carefully in order. Before actually applying the robot, please make sure you understand the described operations correctly.

About the difference between M5 version and PI version machine

The M5 version machine is a joint product of Elephant Robot and Shenzhen Mingzhan Technology Co., Ltd. - M5STACK. It uses the Esp32 core processor and has two display screens and multiple physical buttons. The PI version machine is an official joint product of Elephant Robot and Raspberry Pi. The robotic arm uses the Raspberry Pi RaspBerry PI 4B core processor. It is designed to meet the needs of customers for Linux system applications and the needs of all-in-one integrated robot development and convenient equipment.

PI model robot is a computer host

The PI version machine is embedded with Raspberry Pi 4B, 1.5GHz 4-core microprocessor, runs Debian/Ubuntu platform, supports 4 USB, 2 HDMI, standardized GPIO interface TF card pluggable.

The essence of the PI version machine is a development board with an independent system. It can be regarded as a miniature computer host. The host and the host cannot simply communicate through a line. It can only be connected to an independent monitor, and equipped with a power supply, mouse and keyboard, and then developed and operated after entering the built-in system of the development board.

❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ Tips⚠: Please use the HDMI cable delivered with the package to connect the monitor and use the built-in system for development ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗ ❗

Please follow the following chapters to learn about the pi version of the robotic arm.

- Getting Started with the pi Version of the Robotic Arm This section will introduce how to quickly get started with the PI version of the robotic arm and how to update and upgrade the operating system.
- System Basic Function Description

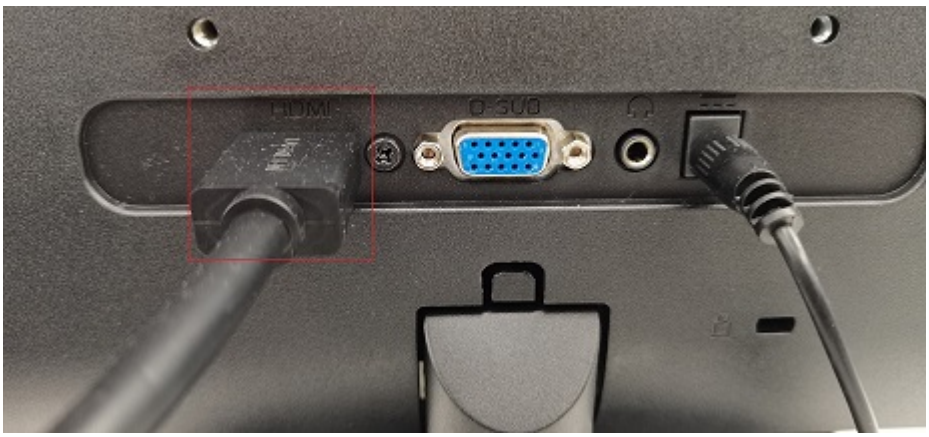
  This section will introduce the Ubuntu operating system and how to configure Bluetooth, VNC, network configuration, and the use of myStudio.
- Firmware Description This section will introduce the general hardware interface of the PI version robot, the factory firmware, and the use of myStudio to burn the Atom firmware.
- mystudio The one-stop service platform myStudio integrates myCobot software resources and various materials, and supports firmware downloads and updates. Provides product usage video tutorials and maintenance/repair information.

← Previous Chapter | Next Chapter →

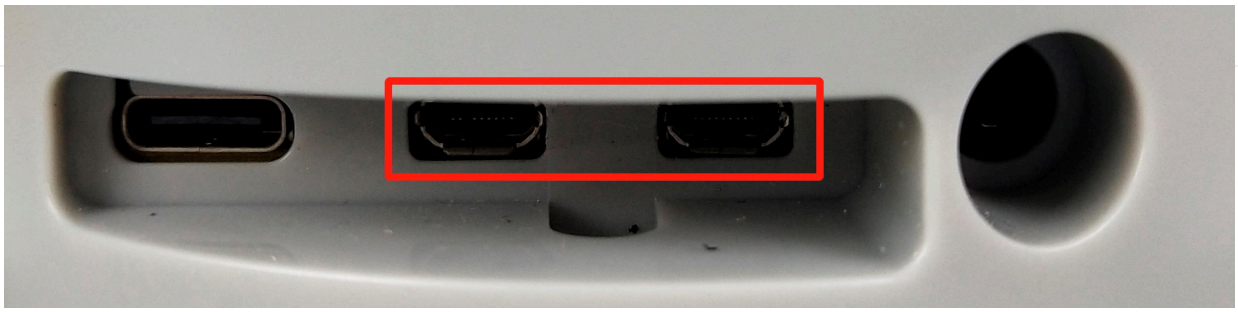
Getting Started with PI Version Robots

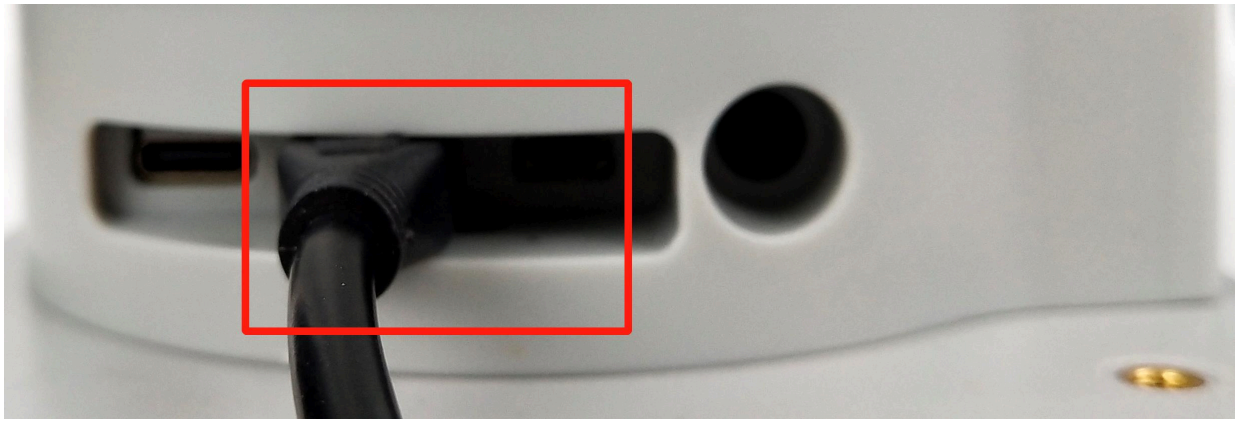
Start Using Your Device

- **Connecting External Devices**
- PI version machines do not need to be paired with PCs, laptops, and other devices. You can develop applications by connecting to a monitor (**Tip⚠: Please use the HDMI cable shipped with the robot to connect to the monitor and use the built-in system for development**)
- First insert the HDMI cable into the HDMI port of the monitor



- Then insert the other end into the HDMI port of the robot arm

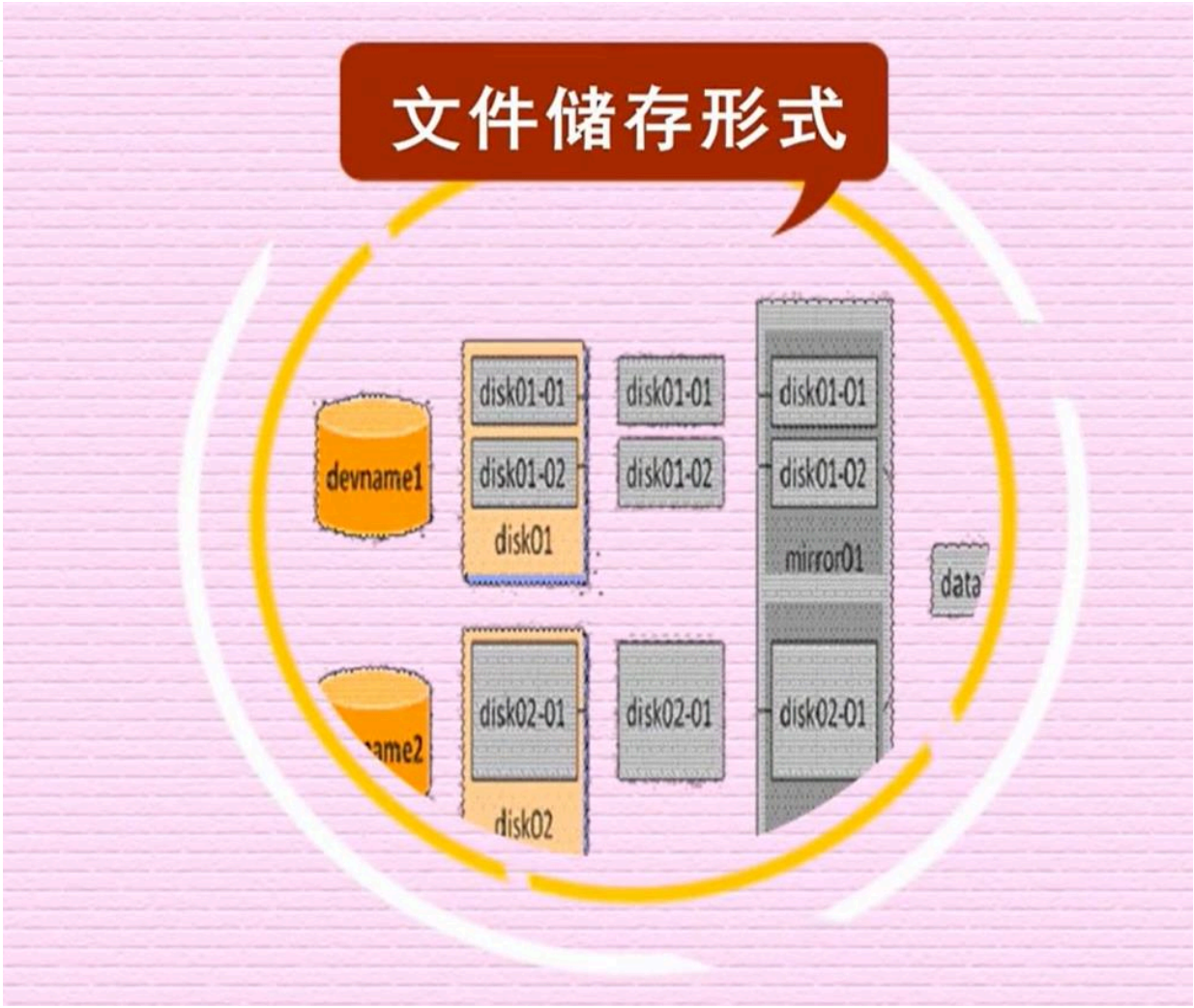




- **System card description**
- 32G TF card, built-in Ubuntu20.04 system, **myStudio firmware burning software**, **myBlockly graphical programming software** installed, and **python ROS** development environment adapted
- **Optional items**
- Network (Ethernet) cable to connect the Raspberry Pi to the local network and the Internet
- If you are not using an HDMI display with speakers, you may also need some sound hardware. Audio can be played through speakers or headphones connected to the AV jack (not available on the Raspberry Pi 400). However, the speakers must have their own amplifiers, as the output of the Raspberry Pi is not powerful enough to drive them directly
- **Troubleshooting**
- Make sure you are using a good quality power supply, we recommend using the official power supply
- Before shutting down the robot, make sure the operating system is properly shut down
- You can get help on using the robot on our gitbook, if you need further information please contact official customer service

Operating system update and upgrade

- **What is mirroring**



- Mirroring is a form of file storage. A mirror is a form of file storage where the data on one disk has an identical copy on another disk. Common image file formats include ISO, BIN, IMG, TAO, DAO, CIF, and FCD. The so-called image file is actually similar to a ZIP compression package. It makes a specific series of files into a single file in a certain format to facilitate users to download and use, such as a beta version of an operating system or game. The image file not only has the "synthesis" function of the ZIP compression package, but its most important feature is that it can be recognized by specific software and can be directly burned to a disc. In fact, the image file in the usual sense can be expanded and can contain more information in the image file. For example, system files, boot files, partition table information, etc., so that the image file can contain all the information of a partition or even a hard disk. The classic software that uses this type of image file is Ghost, which also has a burning function, but its burning only saves the image file itself on the disc, while the burning software in the usual sense can directly burn the content contained in the supported image file to the disc.
- **Download system image file**
- Download link

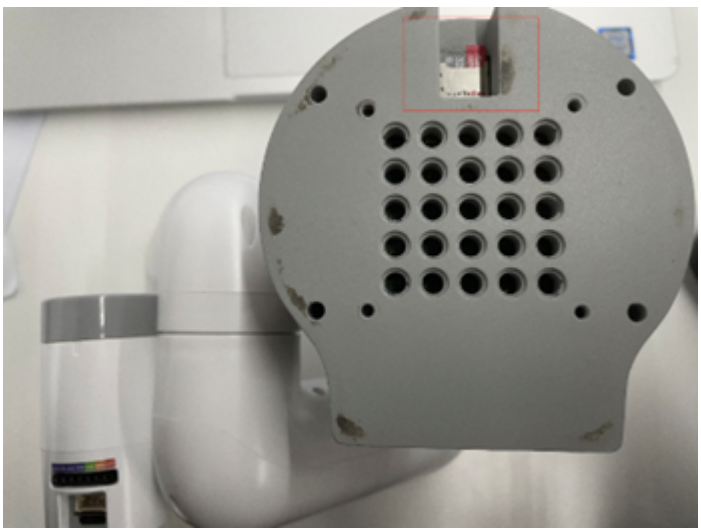
Production Name	Version	Download	SHA256 Hash
myCobot 280 PI	ubuntu 18.04	click it download	04e40af5b637ec003a8b23ef9012e353361fd336db4e17cf9a65feb75e
	ubuntu 20.04	click it download	ce666e6c1047c512fe6b270336d472e48f231be12808729ed57f743f9d

Step 1: Unzip the file after downloading. You can see a CD image file.

Step 2: Download Win32DiskImager software.

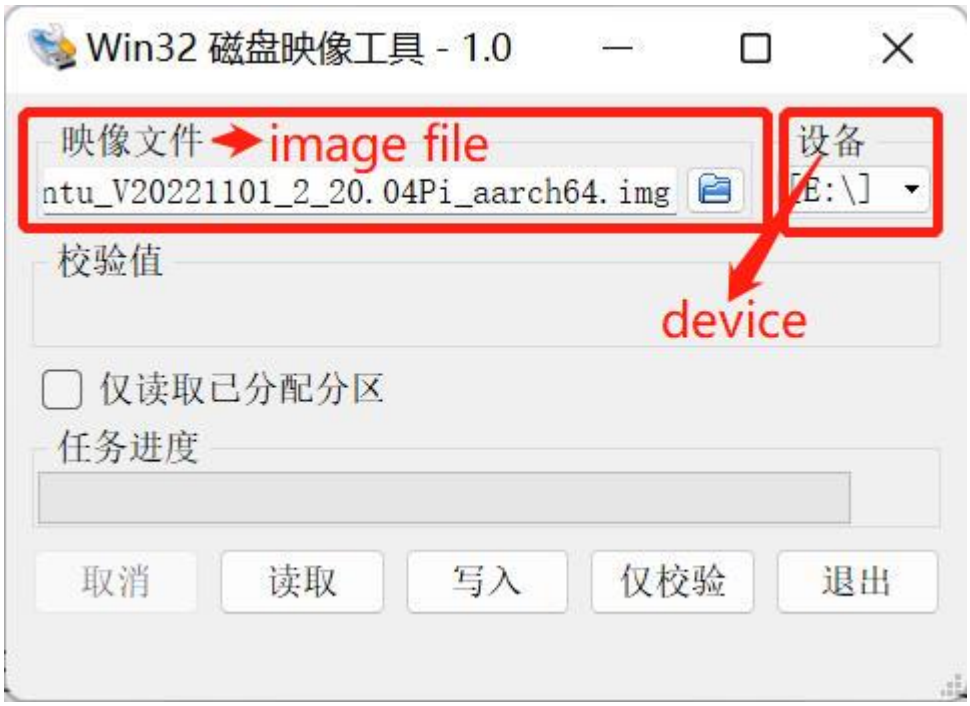
Download address: Win32DiskImager

Step 3: Remove the SD card at the bottom of the robot arm and insert the SD card into the computer using a card reader.

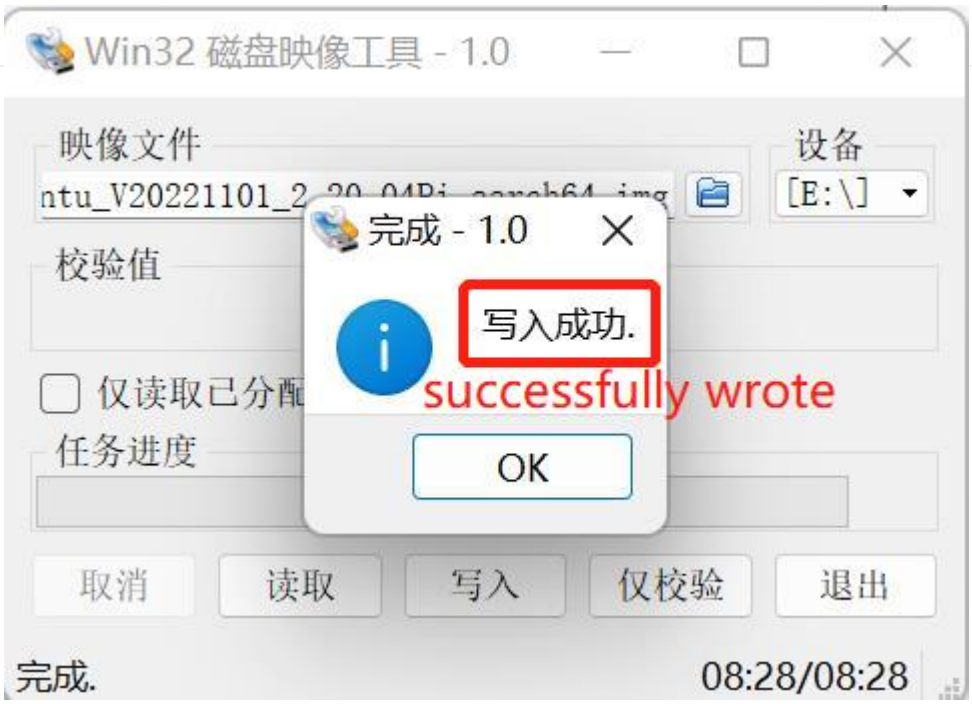


Step 4: Open Win32DiskImager burning software.

Step 5: Select the E drive and the CD image file, then click "Write" to start writing.



Step 6: There will be a prompt after the write is successful.


Win32 磁盘映像工具 - 1.0
映像文件
设备
[E:\]
校验值
仅读取已分配
任务进度
取消
读取
写入
仅校验
退出
完成.
08:28/08:28
完成 - 1.0
写入成功.
successfully wrote
OK

System basic function description

Robot system introduction

- **System introduction**
- Ubuntu is the most widely used Linux operating system in personal desktop operating systems. For beginners, it is a good choice to be familiar with the Linux environment or some embedded hardware operating systems. The Ubuntu official website also released a dedicated operating system for Raspberry Pi.

- **System Function Introduction**
- **myStudio**: Firmware burning software, used to update and burn new versions of firmware
- **myBlockly**: Graphical programming software, you can directly drag and drop blocks to form running codes and control the robot arm
- **ROS1 Shell**: Directly enter the compiled ROS1 environment, you can directly enter the corresponding instructions, and run the corresponding ROS1 code
- **ROS2 Shell**: Directly enter the compiled ROS2 environment, you can directly enter the corresponding instructions, and run the corresponding ROS2 code
- **Github-ElephantRobotics**: Elephant Robotics official open source code repository
- **Home-ElephantRobotics**: Elephant Robotics official website homepage
- **UserManual - CN/EN**: Machine manual, including all content about robot arm control
- **WiFi_ON/OFF**: WiFi switch, click to turn on/off WiFi function
- **HotSpot_ON/OFF**: Hotspot switch, click to turn on/off hotspot function, the hotspot name after turning on is **ElephantRobotics_AP_XXXX**
- **Language Support**: System language setting, click to enter the system language setting interface

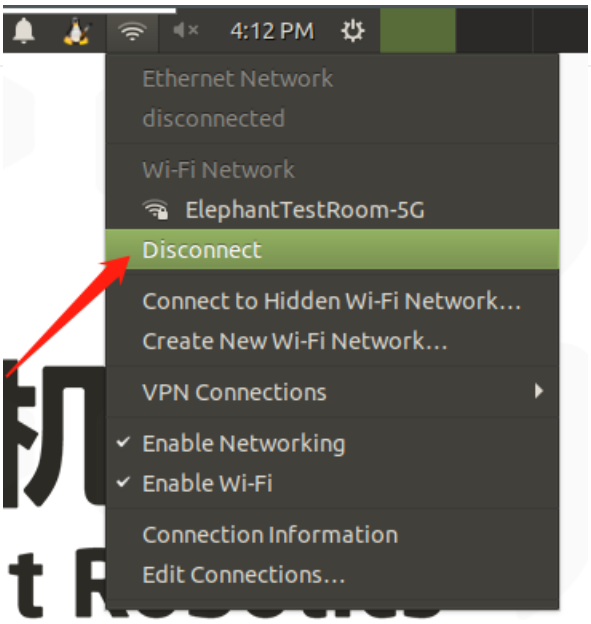
System password description

- **Power-on account password & VNC connection password & SSH connection password & administrator account password**
- Unified as: **Elephant**
- **How to define a new password**
- Change account password
- Use shortcut keys `ctrl + alt + T` to open the terminal
- Enter `passwd` to modify the account password
- Enter the new password twice
- Change VNC connection password
- Use shortcut keys `ctrl + alt + T` to open the terminal
- Enter `vncpasswd` to modify the account password
- Enter the new password twice
- Change SSH connection password
- The SSH remote connection enters the administrator account password, no need to modify it separately
- Change the administrator account password
- Use shortcut keys `ctrl + alt + T` to open the terminal
- Enter `sudo passwd` to modify the account password
- Enter the new password twice

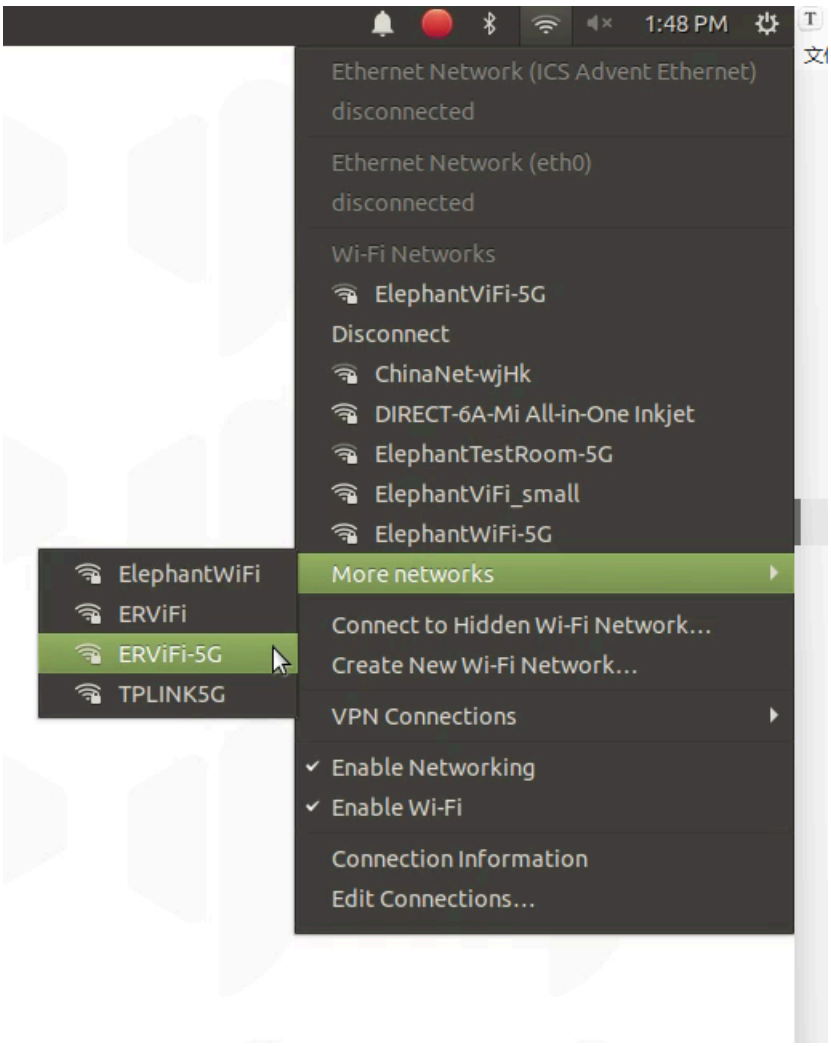
VNC

- **VNC function introduction**
- It is a remote control software, generally used to remotely solve computer problems or software debugging
- **VNC port description**
- The robot arm and PC are connected to the same WiFi, and the robot arm IP address is the port
- **Connect VNC**
- There are two ways to connect. The first way requires an external monitor to perform some operations on the system. The specific steps are as follows:

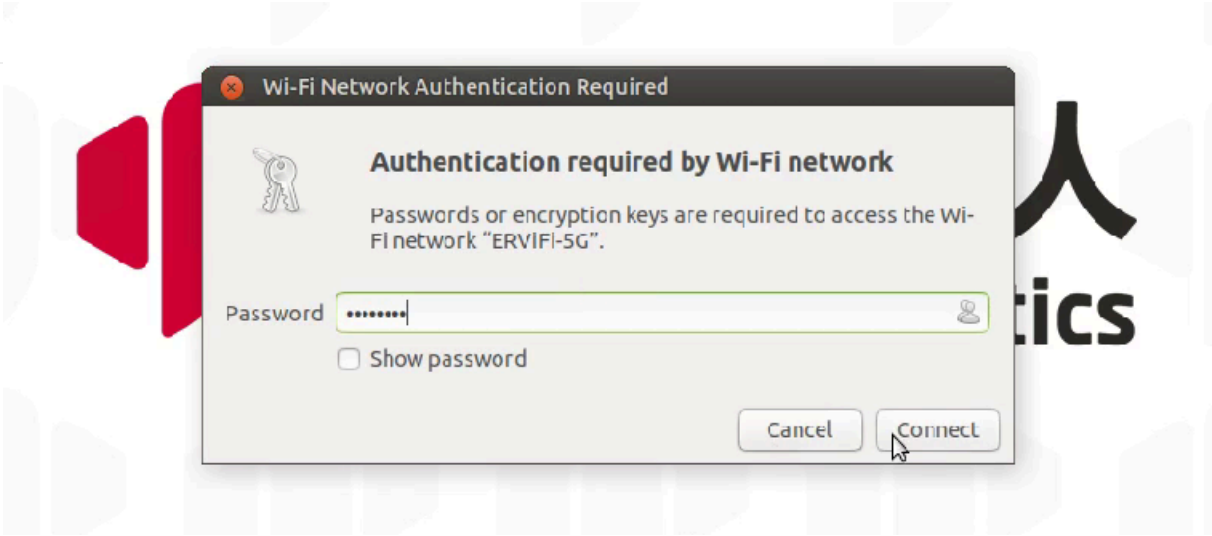
First click **"Disconnect"** to turn off the default hotspot



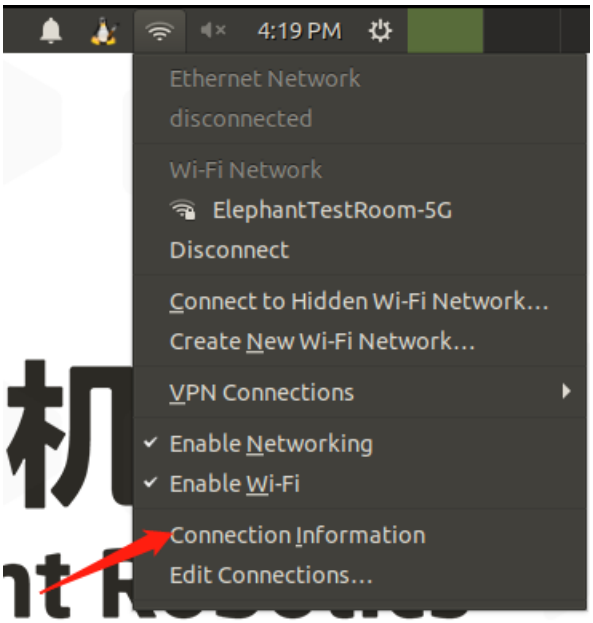
Click **"Enable Wi-Fi"** and wait for the currently available WiFi to be displayed



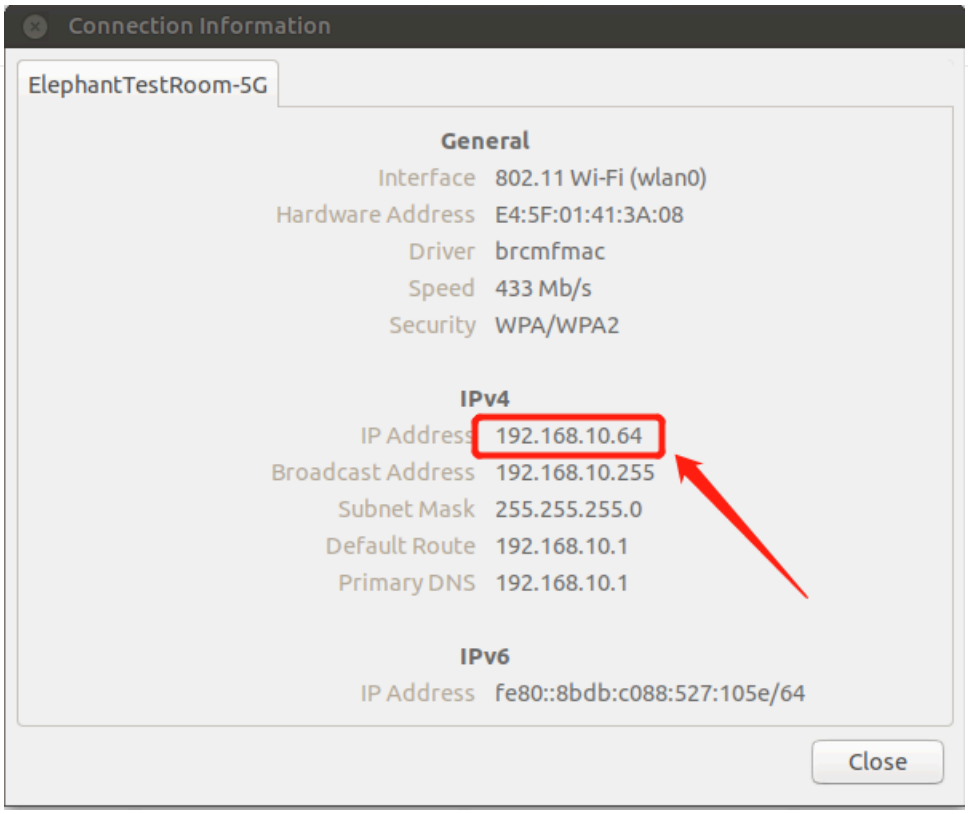
Click the WiFi you want to connect to and enter the WiFi password



After the connection is successful, click **"Connection Information"** to query the current IP address of the robot



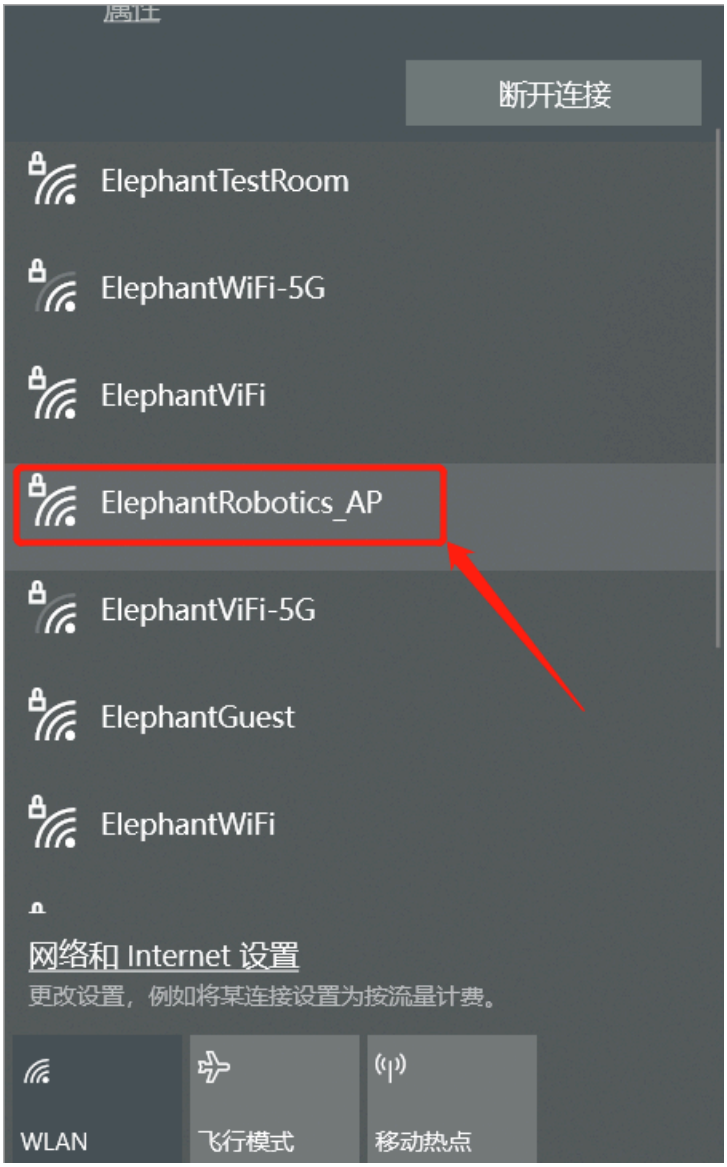
As shown in the example, **"192.168.10.64"** is the current IP address of the robot



Connect your computer and the robot's WiFi to the same WiFi and open VNC viewer software, enter this IP address (in the above case, enter **192.168.10.64**) and press Enter. The password is Elephant. The user name is not filled in by default. The successful connection example is as follows:

- The second method does not require connecting to the display screen. Directly connect the PC to the Ubuntu system hotspot for remote control. However, this connection method does not have the function of surfing the Internet. It can only remotely control the robotic arm system. The specific steps are as follows:

PC selects to connect to the Ubuntu system hotspot **ElephantRobotics_AP_XXXX**, and enters the password **Elephant**

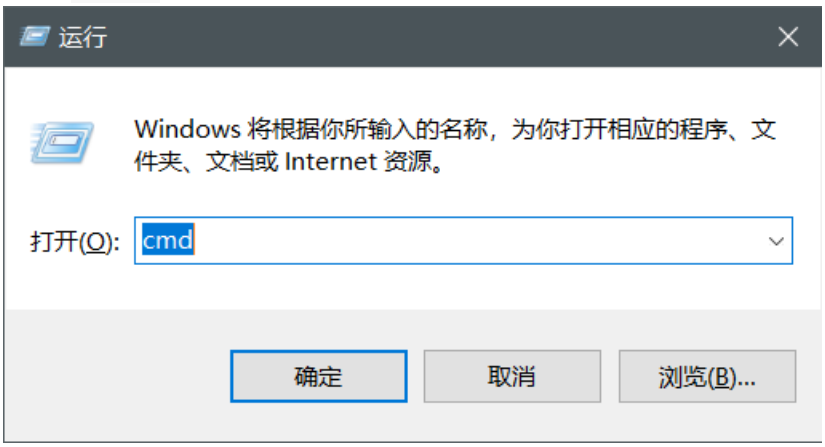


Open the VNC viewer software, enter the IP address **10.42.0.1**, and then press Enter. The password is Elephant. The user name is not filled in by default. The successful connection example is as follows:

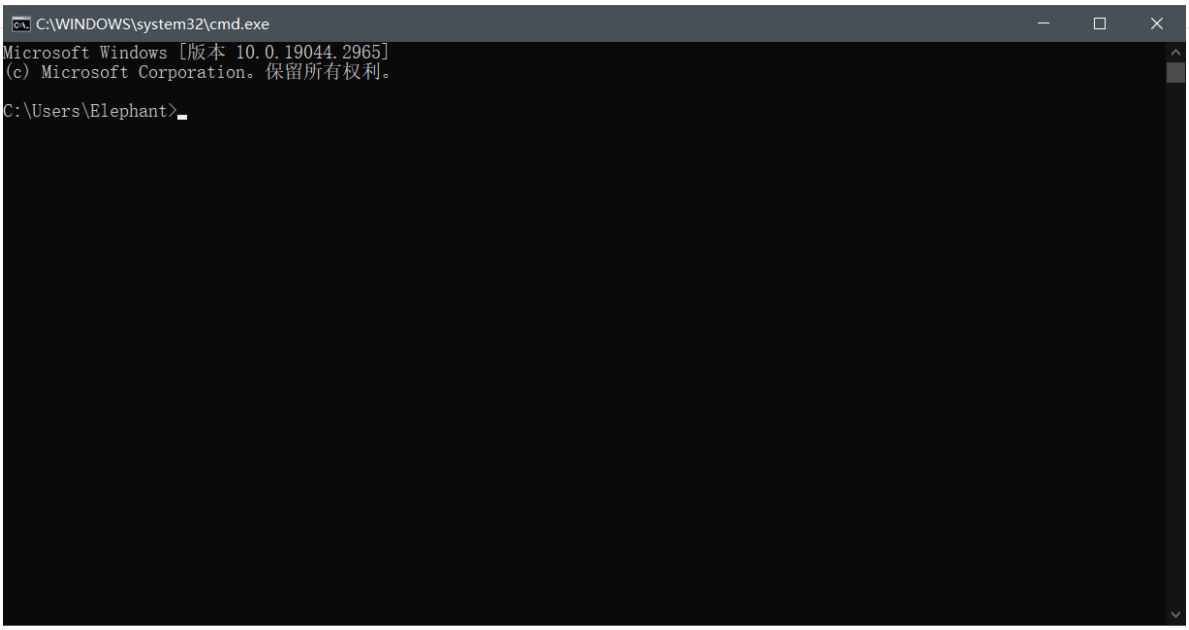
- **How to improve fluency**
- The fluency of remote connection depends on the fluency of the connected WiFi. It is recommended to connect to a stable WiFi for remote control

SSH

- **SSH Function Introduction**
- Simply put, SSH is a network protocol used for encrypted login between computers. If a user logs in to another remote computer from a local computer using the SSH protocol, we can assume that this login is secure, and even if it is intercepted in the middle, the password will not be leaked.
- **SSH port description**
- Default port is 22, no need to change
- **SSH first connection**
- Follow **2.3 VNC** to confirm the IP address of the robot
- Press `win + R` on the personal computer to open the run interface, and enter `cmd` in the input box

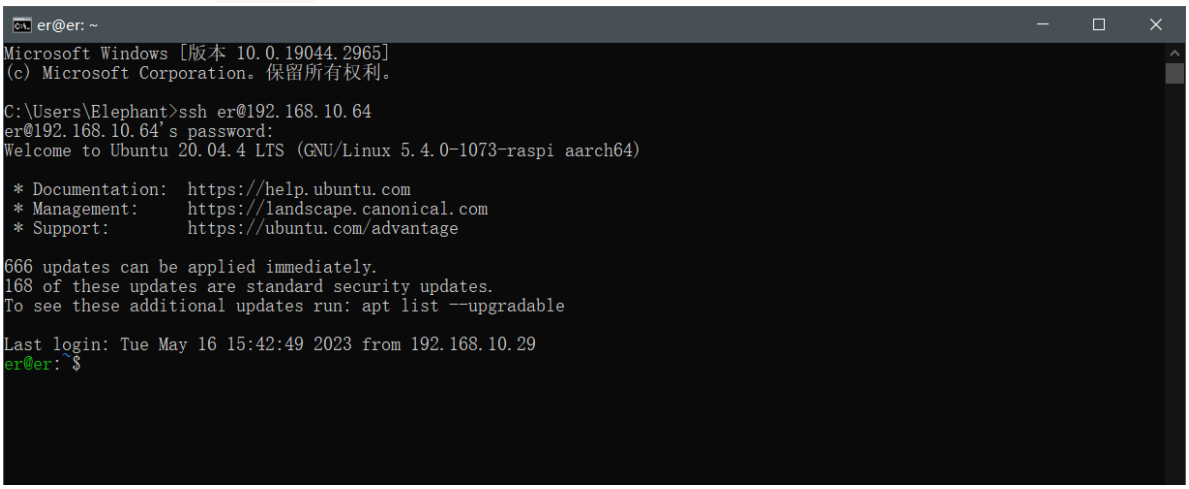


- After entering, click OK to open the shell interface



- Enter `ssh er@IP address` , then press Enter (the IP address is mainly displayed on the robot arm, the picture is just an example)

- Enter the password `Elephant`



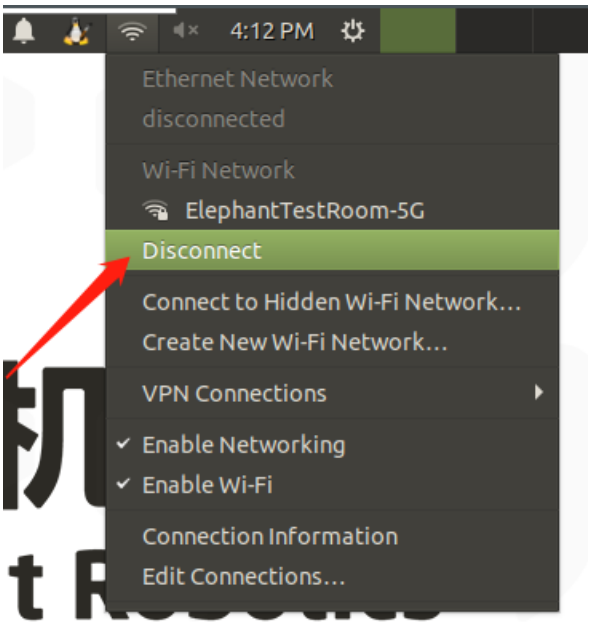
- As shown in the above picture, the remote ssh connection to the robot arm has been successfully completed
- **How to improve fluency**
- The fluency of the remote connection depends on the fluency of the connected WiFi. It is recommended to connect to a stable WiFi for remote control

Network configuration

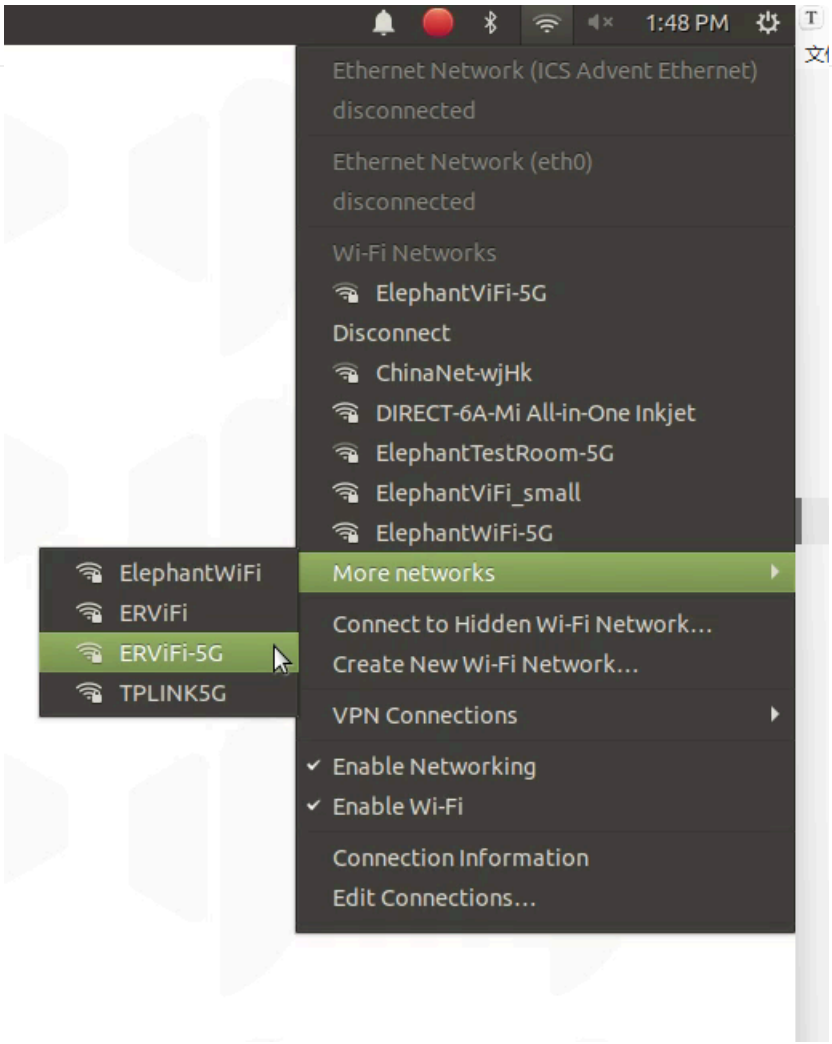
- **Use of default AP**

- After the robot is turned on, the system will connect to the hotspot emitted by the Raspberry Pi by default. The hotspot name is **ElephantRobotics_AP_XXXX**, and the IP address is **10.42.0.1**. This hotspot does not have the function of surfing the Internet, and the transmission rate and amount of information are limited, so there will be some distortion and color difference in the final image, and the communication transmission will also be delayed, which is a normal phenomenon.
- **Connect to WLAN**

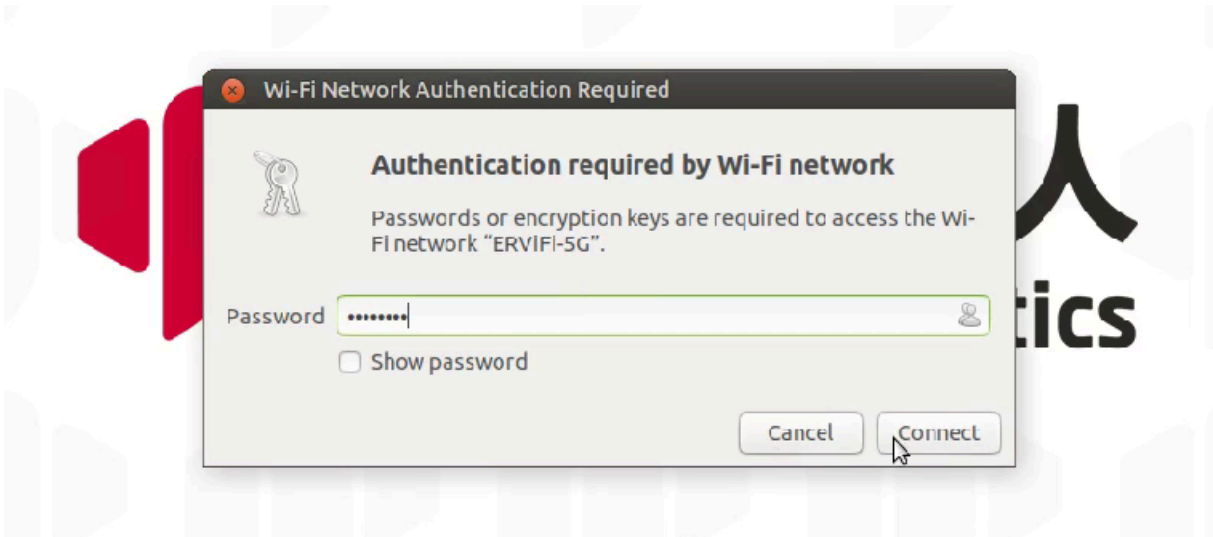
First click **"Disconnect"** to turn off the default hotspot



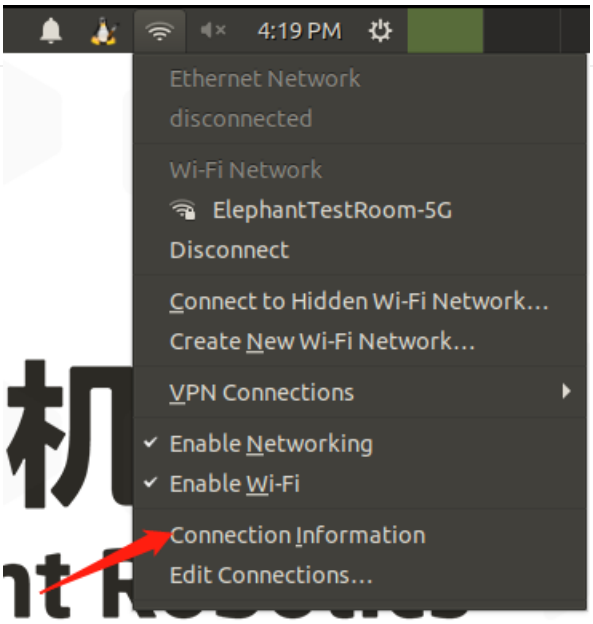
Click **"Enable Wi-Fi"** and wait for the currently available WiFi to be displayed



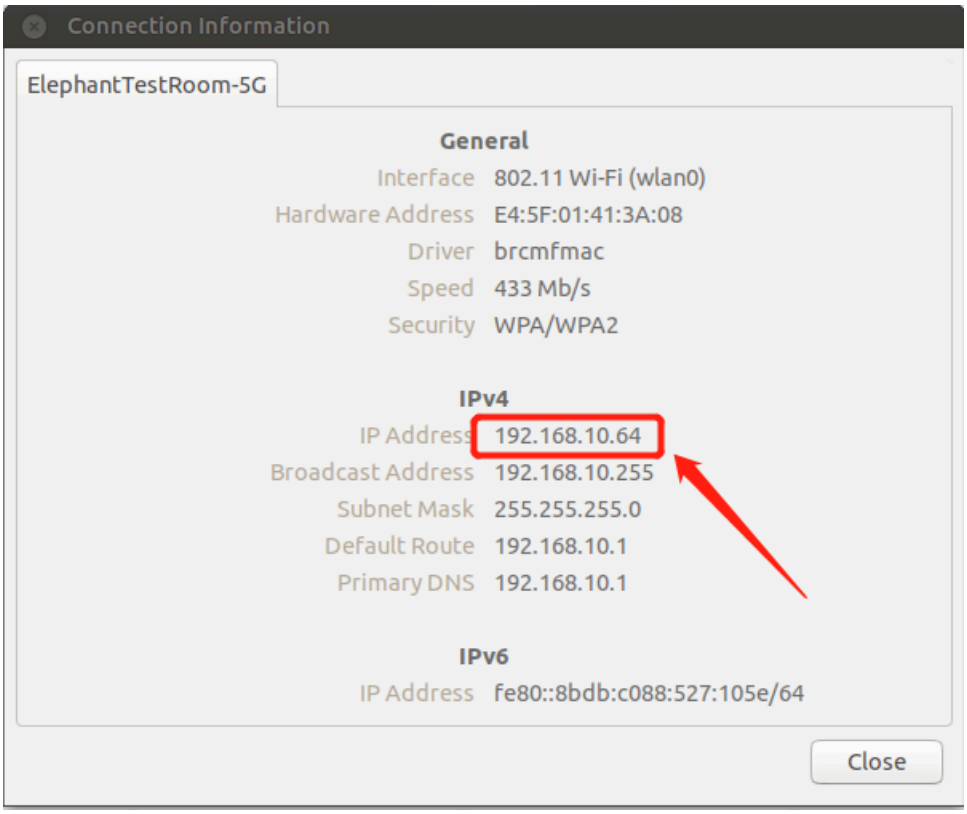
Click the WiFi you want to connect to and enter the WiFi password



After the connection is successful, click **"Connection Information"** to query the current IP address of the robot arm

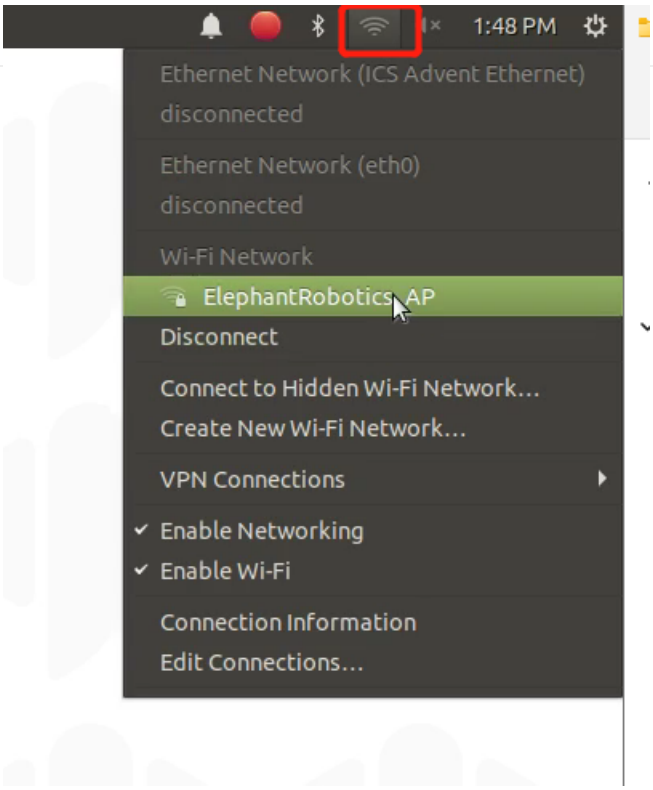


As shown in the example, **“192.168.10.64”** is the current IP address of the robot

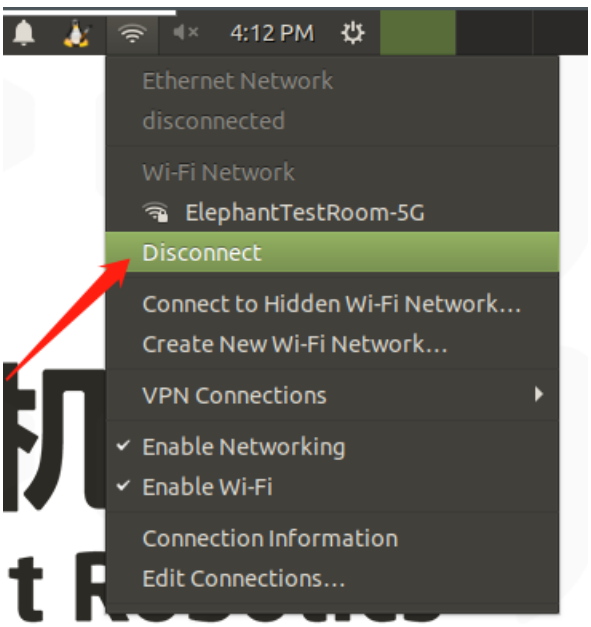


- **Connect to a wired network**

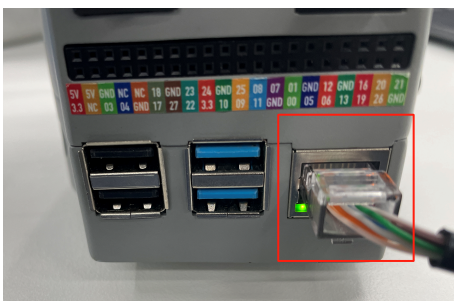
After the robot is turned on, it connects to the system-configured hotspot by default: **ElephantRobotics_AP_XXXX**



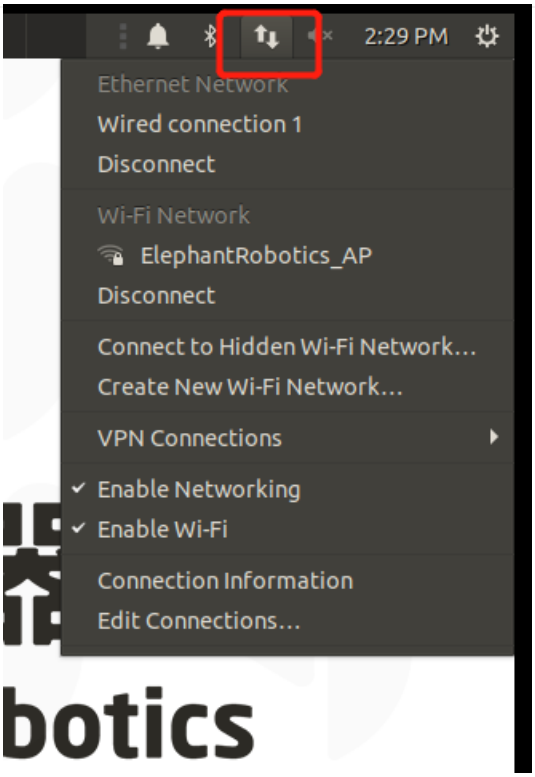
Click **“Disconnect”** to disconnect the default hotspot connection



Connect the network cable to the network port of the robot

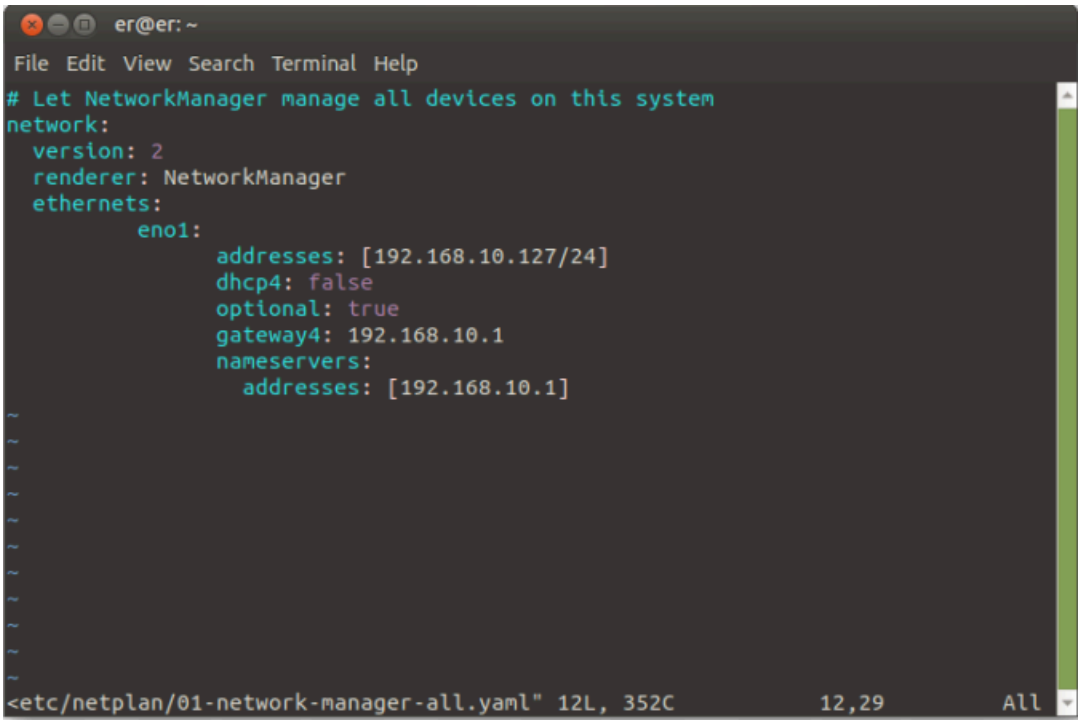


Connect a regular Internet cable to the network port of the robot



- **How to set the default IP address**

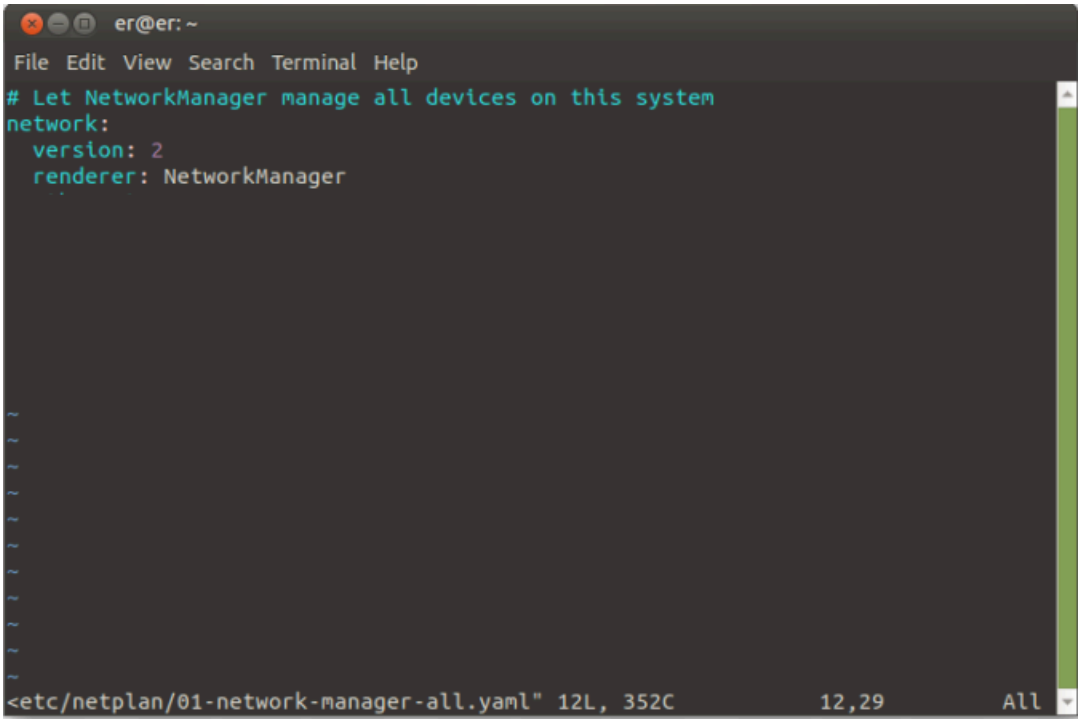
Use the shortcut keys `ctrl + alt + T` to open the terminal, enter `sudo vim /etc/netplan/01-network-manager-all.yaml` , and modify the 01-network-manager-all.yaml file to the following content



After the modification is completed, enter `sudo netplan apply` to make the configuration effective

- **How to automatically assign IP addresses**

When the system is connected to WiFi, the IP address is automatically assigned without any settings. If you want to change from a fixed IP address to an automatically assigned IP address, modify the /etc/netplan/01-network-manager-all.yaml file to the following content



After the modification is completed, enter `sudo netplan apply` to make the configuration effective

Bluetooth configuration

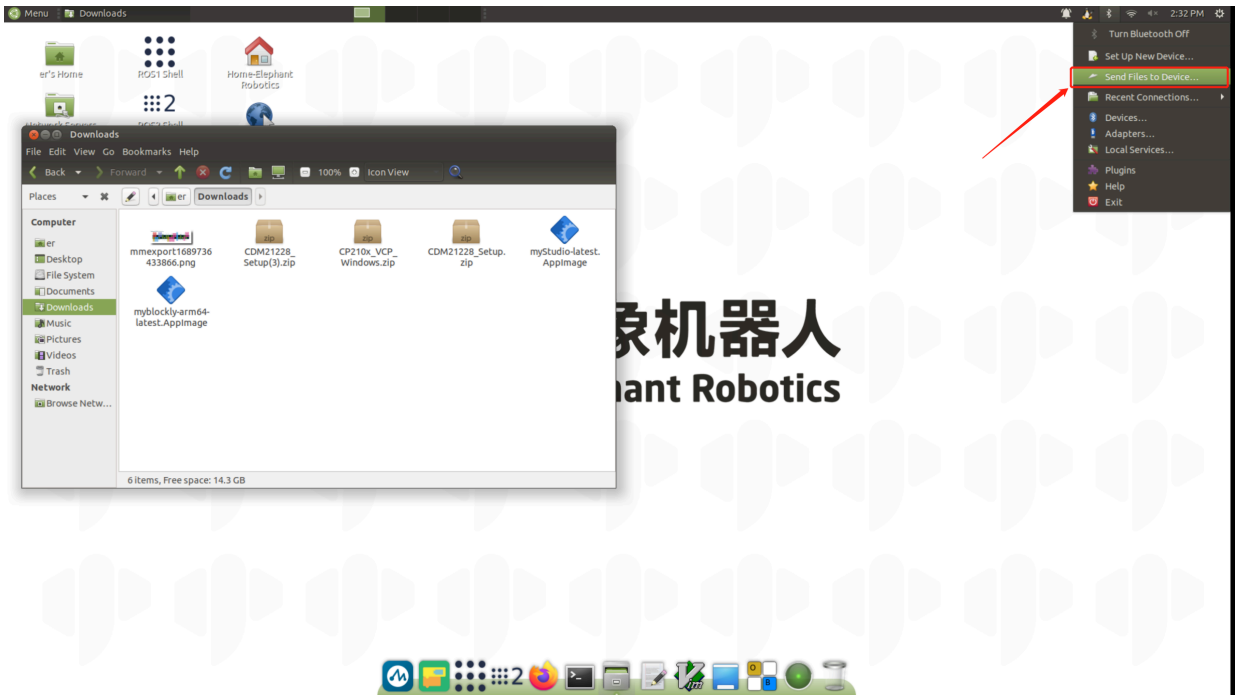
- The Bluetooth of the robot system is turned on by default. You can search it directly with a PC/mobile phone and open the Bluetooth search. As shown in the figure, the default name of Bluetooth is MyCobot-Pi

- Transfer files from PC/mobile phone to robot
- Select the file you want to transfer via Bluetooth and use Bluetooth to transfer
- Operate in the robot system and select to receive the file

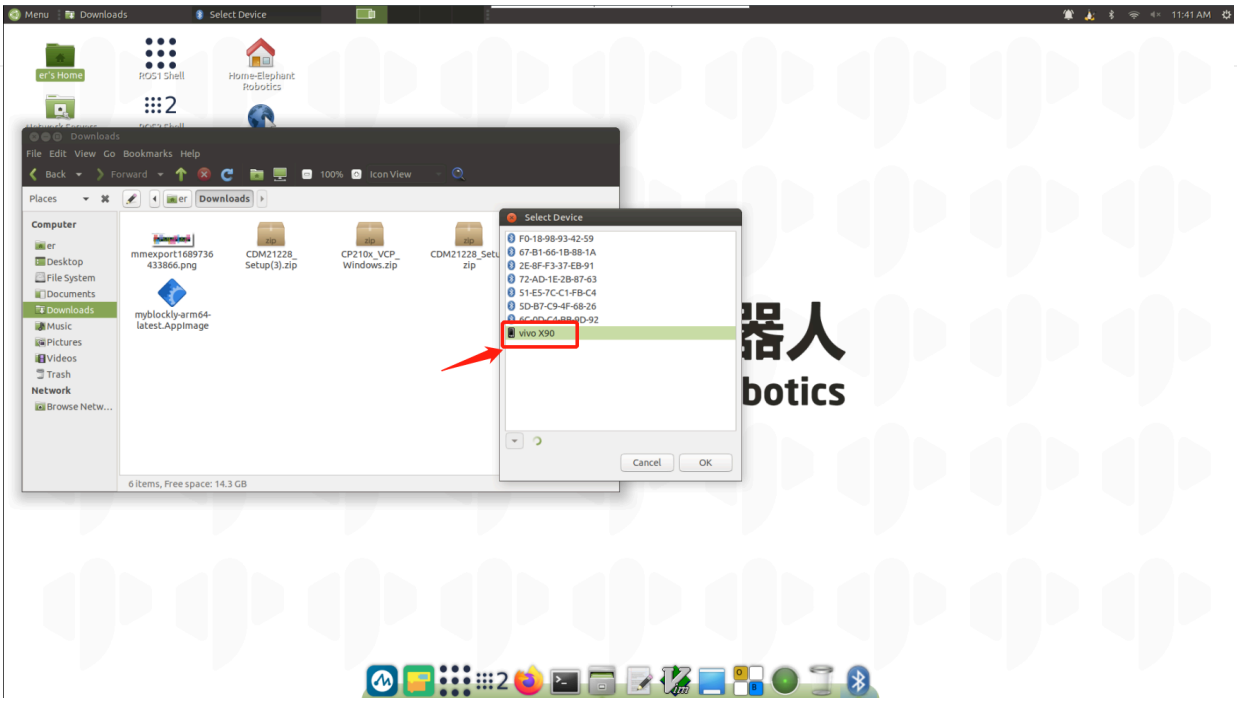
- Wait for Bluetooth transmission to complete

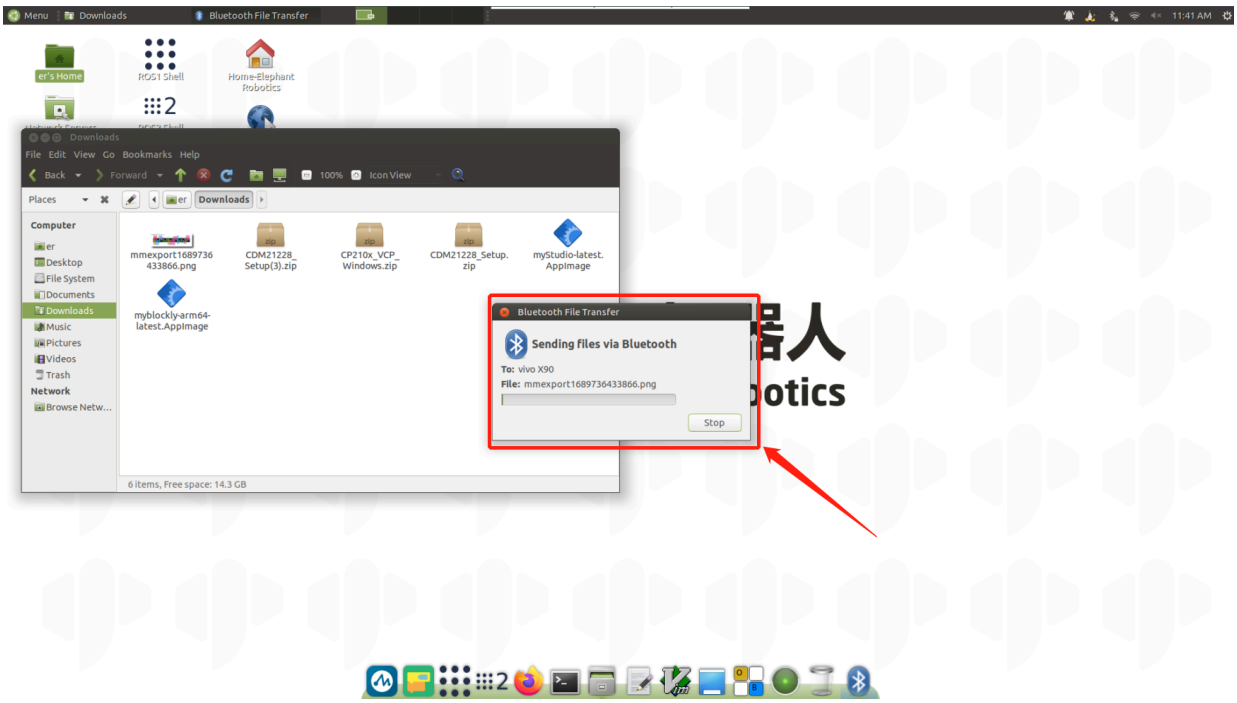
- You can see the files transferred by Bluetooth in the **/home/er/Downloads** folder

- Transfer files from the robot system to the PC/mobile phone
- Click the Bluetooth icon in the system and select **Send Files to Device** in the drop-down display box



- Select PC/mobile phone





- On the PC/mobile phone, allow receiving files to transmit information from the robot arm to the mobile phone

Language Configuration

- **How to switch languages**

Click **Language Support** on the desktop to enter the language switching interface, drag the language you want to change to the top, and restart the system

- **How to download languages**

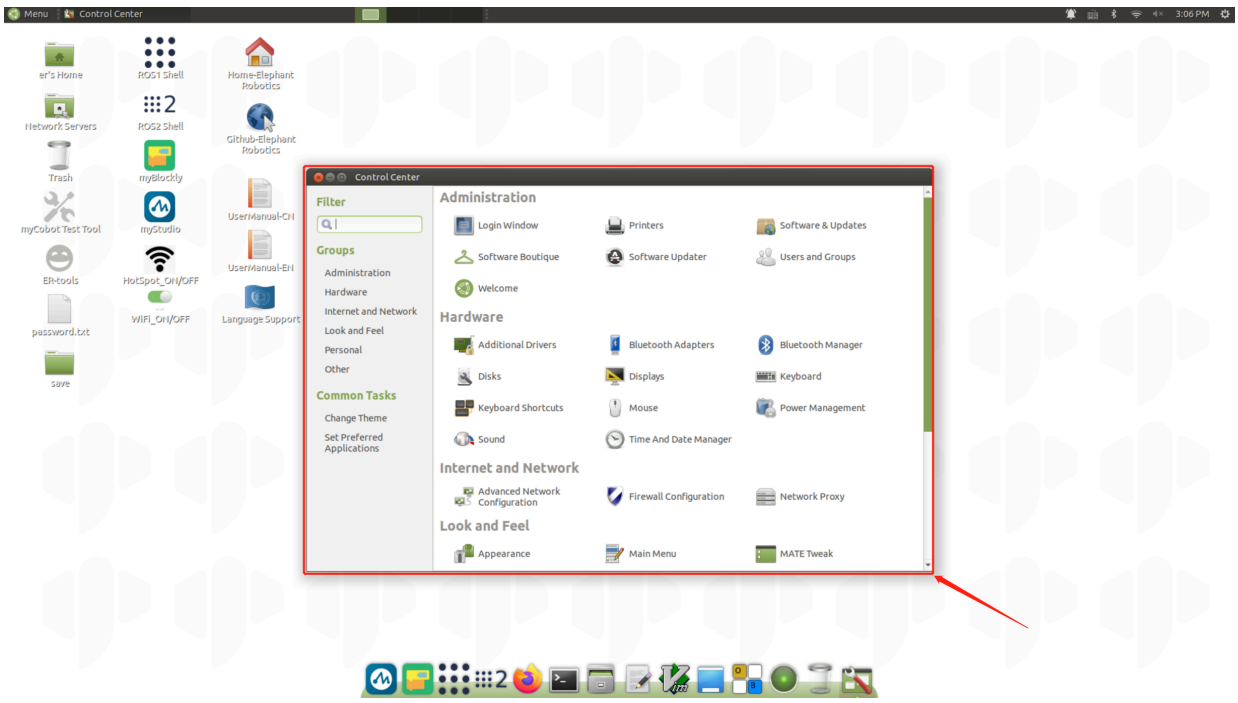
Click **Language Support** on the desktop to enter the language switching interface, drag the language you want to change to the top, and restart the system

- **How to download languages**

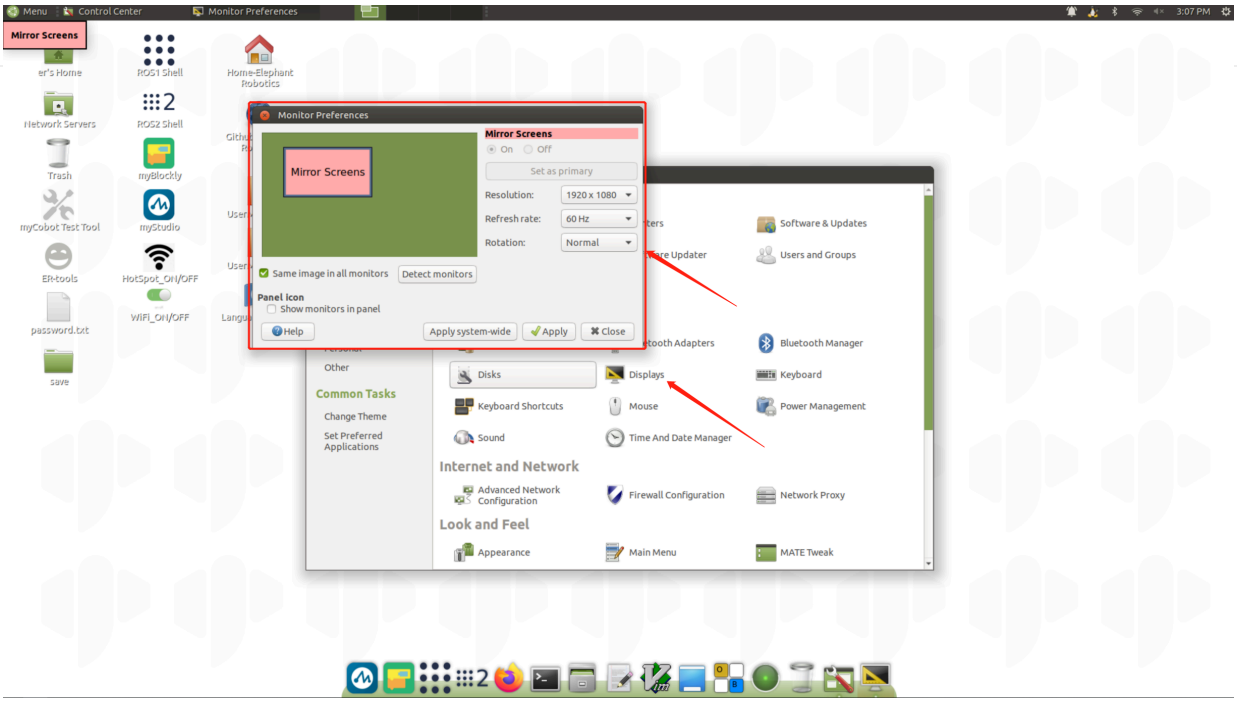
Click **Language Support**Enter the language switching interface, select the language, click Download, and enter the password**Elephant**

System resolution switching

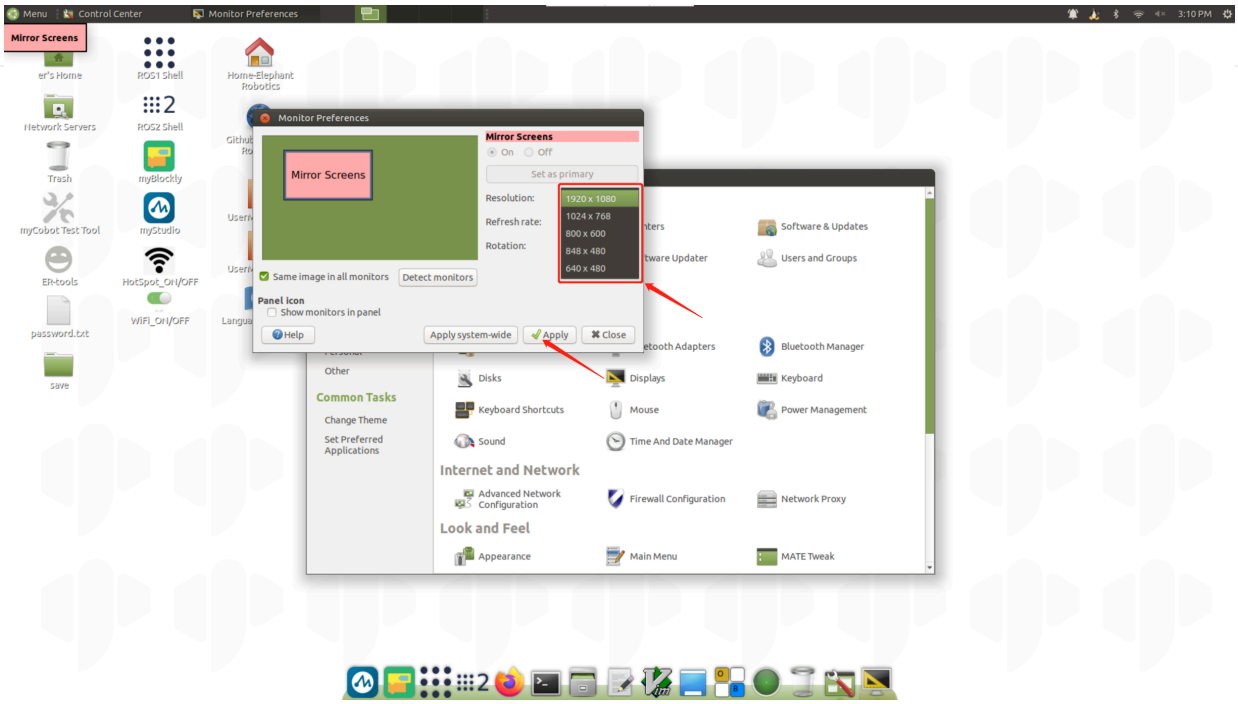
- Click the icon in the upper right corner of the screen, select **System Settings**, and enter the system control panel

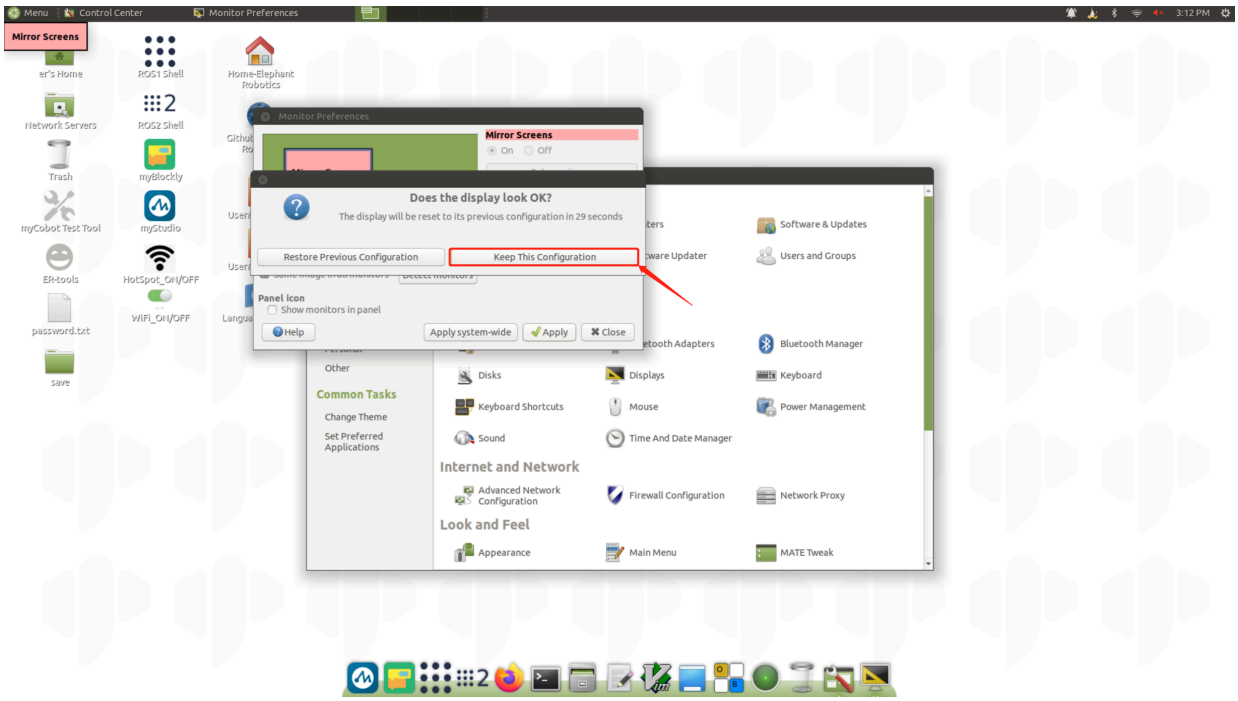


- Select **Display** and enter the resolution selection page



- Switch to select the resolution, click **Apply** to view the display effect, if it meets the requirements, click **Keep this Configuration**





python

- **Introduction to Python for the robot system**

Python3.8 is installed in the system, no need to install it yourself

Already in accordance with Python dependencies:

Package	Version
pymycobot	3.0.9
pyserial	3.5
numpy	1.23.5
opencv-contrib-python	4.7.0.72
rospkg	1.4.0
rospkg-modules	1.4.0

- **First time using python**

  Enter

  ```
  python3
  ```

  in the terminal to enter the Python compilation environment.

  The `>>>` sign appears, indicating that you have entered the Python environment.

You can try this code in the input box:

```
print ("Hello World!")
```

You can enter `pip list` in the terminal to view the existing Python packages

- **Running robot case code**

For specific case codes, please refer to the Python chapter. Simply copy the code in the case and use it.

Factory firmware introduction

Only introduce the myCobot series, myPalletizer series and mechArm series, which are divided into two categories: microcontrollers and microprocessors.

- Microcontroller devices:
- myCobot 280 M5
- myCobot 320 M5
- myPalletizer 260 M5
- mechArm 27 M5
- Microprocessor devices
- myCobot 280 Pi
- myCobot 320 Pi
- mechArm 270 Pi

The difference between microprocessors and microcontrollers is mainly concentrated in three aspects: hardware structure, application field and instruction set characteristics:

- Hardware structure. The microprocessor is a single-chip CPU, while the microcontroller integrates the CPU and other circuits in an integrated circuit chip to form a complete microcomputer system. In addition to the CPU, the microcontroller also includes RAM, ROM, a serial interface, a parallel interface, a timer and an interrupt scheduling circuit.
- Application field. Microprocessors are usually used as CPUs in microcomputer systems. They are designed for such applications, which is also the advantage of microprocessors. However, microcontrollers are usually used in control-oriented applications, and the system design pursues miniaturization and minimizes the number of components. Microcontrollers are suitable for those occasions where input/output devices are controlled with very few components, while microprocessors are suitable for information processing in computer systems.
- Instruction set characteristics. Due to different applications, the instruction sets of microcontrollers and microprocessors are also different. The instruction set of microprocessors enhances processing capabilities, giving them powerful addressing modes and instructions suitable for operating large-scale data. Microprocessor instructions can operate on nibbles, bytes, words, and even double words. By using address pointers and address offsets, microprocessors provide addressing modes that can access large amounts of data. The self-increment and self-decrement modes make it very easy to access data in units of bytes, words, or double words.

Factory firmware for microprocessor devices: python demo

Currently, the python demos available for microprocessor devices are:

- Drag teaching routine drag_trial_teaching
- Drag teaching.

The operator can directly drag the robot joints to move to the ideal posture, and save the action in the machine by keyboard operation. Collaborative robots are the earliest systems with this function. This teaching method can avoid various shortcomings of traditional teaching and is a technology with great application prospects in robots.

- rasp_mycobot_test_gui

This python demo is a test tool for microprocessor devices, including the functions of calibrating the robot arm and connection detection.

- Calibrate the robot arm is the prerequisite for precise control of the robot arm. Setting the joint zero position and initializing the potential value of the motor are the basis for subsequent advanced development.
- Connection detection is a detection function for the connection status of the motor and Atom in the robot arm. This function is convenient for customers to troubleshoot equipment failures. In the connection detection, the device connection status of the robot arm is seen, including the connection of the servo and the communication status of the Atom. The current firmware version of the device will be displayed on M5Stack-basic in the microcontroller device.
- Computer Control Currently, the 280pi robot can be remotely controlled using VNC and SSH.

General Hardware Interface Description

40PIN GPIO

- **Introduction**
- GPIO stands for General-purpose input/output
- Currently, all our Raspberry Pi motherboards have a 40-pin GPIO header
- **Voltage Description**
- There are two 5V pins and two 3.3V pins on the board, as well as multiple ground pins (0V), which are not configurable. The remaining pins are general 3.3V pins, which means that the output is set to 3.3V and the input allows 3.3V
- **IO Output**
- GPIO pins designated as output pins can be set to high (3.3V) or low (0V)
- **IO Input**
- GPIO pins designated as input pins can be read as high (3.3V) or low (0V). This is easier to do using internal pull-up or pull-down resistors. Pins GPIO2 and GPIO3 have fixed pull-up resistors, but for other pins this can be configured in software
- **PWM (Pulse Width Modulation)**
- All pins can use software controlled PWM
- GPIO12, GPIO13, GPIO18, GPIO19 can use hardware controlled PWM
- **SPI**
- SPI stands for Serial Peripheral Interface, which is a high-speed, full-duplex, synchronous communication bus
- SPI0: MOSI (GPIO10); MISO (GPIO9); SCLK (GPIO11); CE0 (GPIO8), CE1 (GPIO7)
- SPI1: MOSI (GPIO20); MISO (GPIO19); SCLK (GPIO21); CE0 (GPIO18); CE1 (GPIO17); CE2 (GPIO16)
- **IIC**
- I2C, the full name of which is Integrated Circuit Bus in Chinese, is a serial communication bus that uses a multi-master-slave architecture
- Data (GPI02), clock (GPI03)
- EEPROM data: (GPIO0), EEPROM clock (GPI01)
- **Serial**

- Serial port is the abbreviation of serial port, also known as serial communication interface or COM interface
- TX (GPIO14), RX (GPIO15)
- **python control pin output**

```
import RPi.GPIO as GPIO
import time

# Initialization
GPIO.setmode(GPIO.BCM)
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)
# High level
GPIO.output(20, 0)
GPIO.output(21, 0)
# Wait for 2 seconds
time.sleep(2)
# Low level
GPIO.output(20, 1)
GPIO.output(21, 1)
```

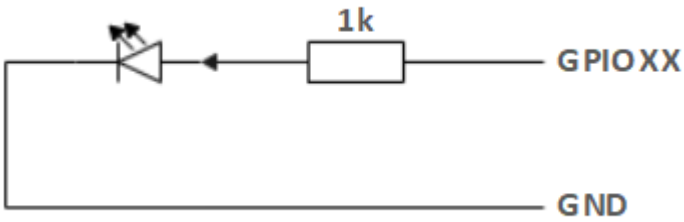
- **The definitions of each GPIO interface are shown in the following table:

Table 3.5.2.1-1

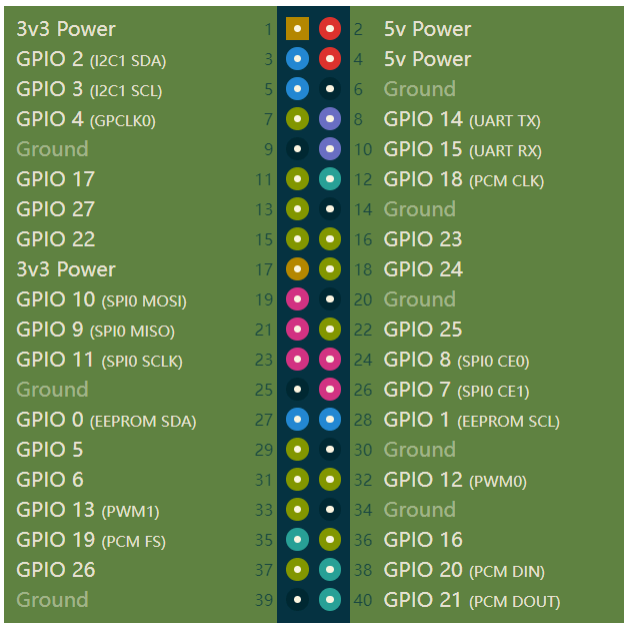
Label	Signal Name	Type	Function	Remarks
5V	5V	P	DC 5V	
5V	5V	P	DC 5V	
GND	GND	p	GND	
NC	NC	-	-	Not supported yet
NC	NC	-	-	Not supported yet
18	GPIO18	I/O	GPIO18	
GND	GND	p	GND	
23	GPIO23	I/O	GPIO23	
11	GPIO11	I/O	GPIO11	
GND	GND	p	GND	
00	GPIO0	I/O	GPIO0	
05	GPIO5	I/O	GPIO5	
06	GPIO6	I/O	GPIO6	
13	GPIO13	I/O	GPIO13	
19	GPIO19	I/O	GPIO19	
26	GPIO26	I/O	GPIO26	
GND	GND	p	GND	

	24	GPIO24	I/O	GPIO24	

> **Note:**
>
> 1. I: Input only.
> 2. I/O: This function signal contains input and output combination.
> 3. When the tube corner is set as an output, it will output a voltage of 3.3V.
> 4. The pull current of a single tube corner decreases as the number of pins increases, from about 40mA to 29mA.
> 5. If a GPIO is set to output mode, it outputs a high-level signal, and the circuit connection is shown in Figure 2.1.5.2-3, and the LED light will light up.

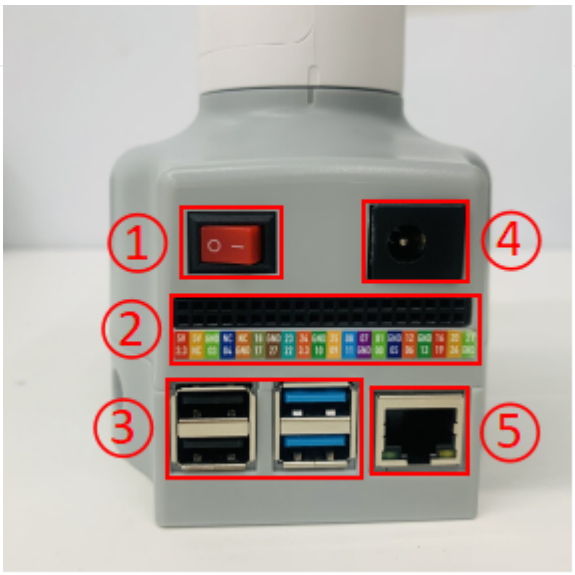


> 1. The other function tables of the function interface are shown in Figure 2.1.5.2-4. When other functions are used, the IO function is not available.



3.2 Introduction to the base interface of the robot

- A. The front of the base is shown in the figure:



Front of the base

- ① Switch button
- ② Function interface group 1
- ③ USB2.0, USB3.0
- ④ Power DC interface -⑤ Network port

- B. The side of the base is shown in the figure:

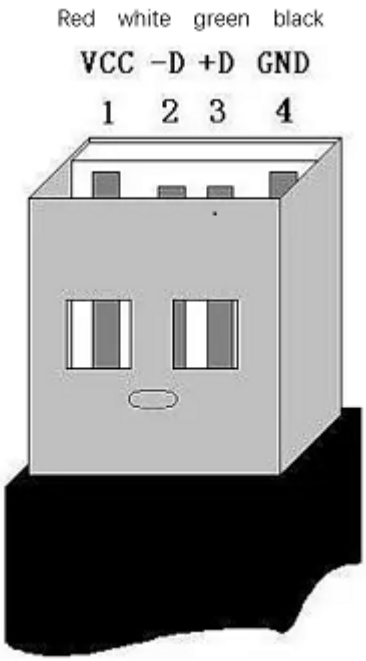
Side of the base

- ① SD card slot
- ② Type C
- ③ HDMI
- ④ Audio interface

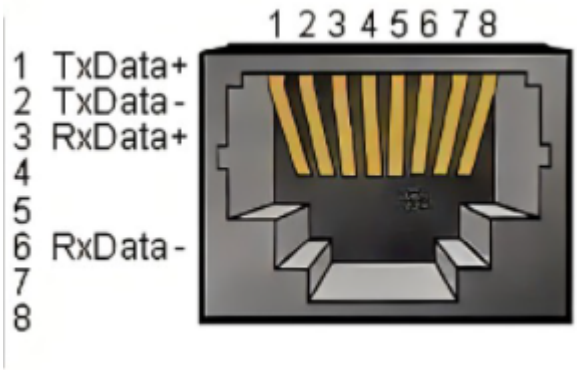
Detailed description of the robot base interface

- A. Power DC interface: Use a DC power socket with an outer diameter of 6.5mm and an inner diameter of 2.0mm; the 12V 5A DC power adapter provided by the manufacturer can be used to power myCobot280.
- B. Switch button: Red is the switch, I is for power on, and O is for power off.

- C. USB2.0 interface: an interface for data connection based on serial bus standard 2.0; users can use the USB interface to copy program files, or use the USB interface to connect peripherals such as mouse and keyboard.
- D. USB3.0 interface (blue): an interface for data connection based on serial bus standard 3.0; users can use the USB interface to copy program files, or use the USB interface to connect peripherals such as mouse and keyboard.



- E. Network port: a port for network data connection. Users can use the Ethernet interface for communication and interaction between the PC and the robot system, or for Ethernet communication with other devices.



- F. HDMI interface: The interface is HDMI D-type interface, connected to the display. HDMI interface 2 has priority, and HDMI interface 1 is recommended.
- G. Type C interface: can be used to connect and communicate with the PC and update the firmware.
- H. SD card slot: SD card can be inserted and removed. The size of the SD card is 32mm×24mmx2.1mm

Implement drag teaching

Applicable devices

- myCobot 280 Pi
- myCobot 320 Pi
- mechArm 270 Pi
- myArm 300 Pi
- myPalletizer 260

Operation steps

Step 1: Atom burns the latest version of **atomMain**.

Step 2: Create a new Python file named ***.py** on the desktop, copy the following code into it and save it.

> **Note:** The file is named: drag_trial_teaching.py.

Github download address

```
import time
import os
import sys
import termios
import tty
import threading
import json
import serial
import serial.tools.list_ports

from pymycobot.mycobot280 import MyCobot280
from pymycobot.mycobot320 import MyCobot320
from pymycobot.mecharm270 import MechArm270
from pymycobot.myarm import MyArm
from pymycobot.mypalletizer260 import MyPalletizer260

port: str
mc: MyCobot280
sp: int = 80



def setup():
    global port, mc

    print("")

    print("1 - MyCobot280")
    print("2 - MyCobot320")
    print("3 - MechArm270")
    print("4 - MyArm300")
    print("5 - MyPalletizer260")
    _in = input("Please input 1 - 5 to choose:")
    robot_model = None
    if _in == "1":
        robot_model = MyCobot280
        print("MyCobot280\n")
        print("Please enter the model type:")
        print("1. Pi")
        print("2. Jetson Nano")
        print("Default is Pi")
        model_type = input()

        if model_type == "2":
            port = "/dev/ttyTHS1"
        else:
            pass
    elif _in == "2":
        robot_model = MyCobot320
        print("MyCobot320\n")
```

```
    elif _in == "3":
        robot_model = MechArm270
        print("MechArm270\n")

    elif _in == "4":
        robot_model = MyArm
        print("MyArm300\n")

    elif _in == '5':
        robot_model = MyPalletizer260
        print('MyPalletizer260\n')

    else:
        print("Please choose from 1 - 5.")
        print("Exiting...")
        exit()

    plist = list(serial.tools.list_ports.comports())
    idx = 1
    for port in plist:
        print("{} : {}".format(idx, port))
        idx += 1

    if not plist:
        pass
    else:
        _in = input("\nPlease input 1 - {} to choice:".format(idx - 1))
        port = str(plist[int(_in) - 1]).split(" - ")[0].strip()
    print(port)
    print("")

    baud = 1000000
    _baud = input("Please input baud(default:1000000):")
    try:
        baud = int(_baud)
    except Exception:
        pass
    print(baud)
    print("")

    DEBUG = False
    f = input("Wether DEBUG mode[Y/n](default:n):")
    if f in ["y", "Y", "yes", "Yes"]:
        DEBUG = True
    mc = robot_model(port, baud, debug=DEBUG)
    mc.power_on()


class Raw(object):
    """Set raw input mode for device"""
```

```
    def __init__(self, stream):
        self.stream = stream
        self.fd = self.stream.fileno()

    def __enter__(self):
        self.original_stty = termios.tcgetattr(self.stream)
        tty.setcbreak(self.stream)

    def __exit__(self, type, value, traceback):
        termios.tcsetattr(self.stream, termios.TCSANOW, self.original_stty)


class Helper(object):
    def __init__(self) -> None:
        self.w, self.h = os.get_terminal_size()

    def echo(self, msg):
        print("\r{}".format(" " * self.w), end="")
        print("\r{}".format(msg), end="")


class TeachingTest(Helper):
    def __init__(self, mycobot) -> None:
        super().__init__()
        self.mc = mycobot
        self.recording = False
        self.playing = False
        self.record_list = []
        self.record_t = None
        self.play_t = None
        self.path = os.path.dirname(os.path.abspath(__file__)) + "/record.txt"

    def record(self):
        self.record_list = []
        self.recording = True

        # self.mc.set_fresh_mode(0)
        if isinstance(self.mc, MyCobot320):
            self.mc.release_all_servos(1)
        else:
            self.mc.release_all_servos()

        def _record():
            while self.recording:
                start_t = time.time()
                if isinstance(self.mc, (MyArm, MyPalletizer260)):
                    angles = self.mc.get_encoders()
                    interval_time = time.time() - start_t
                    if angles:
```

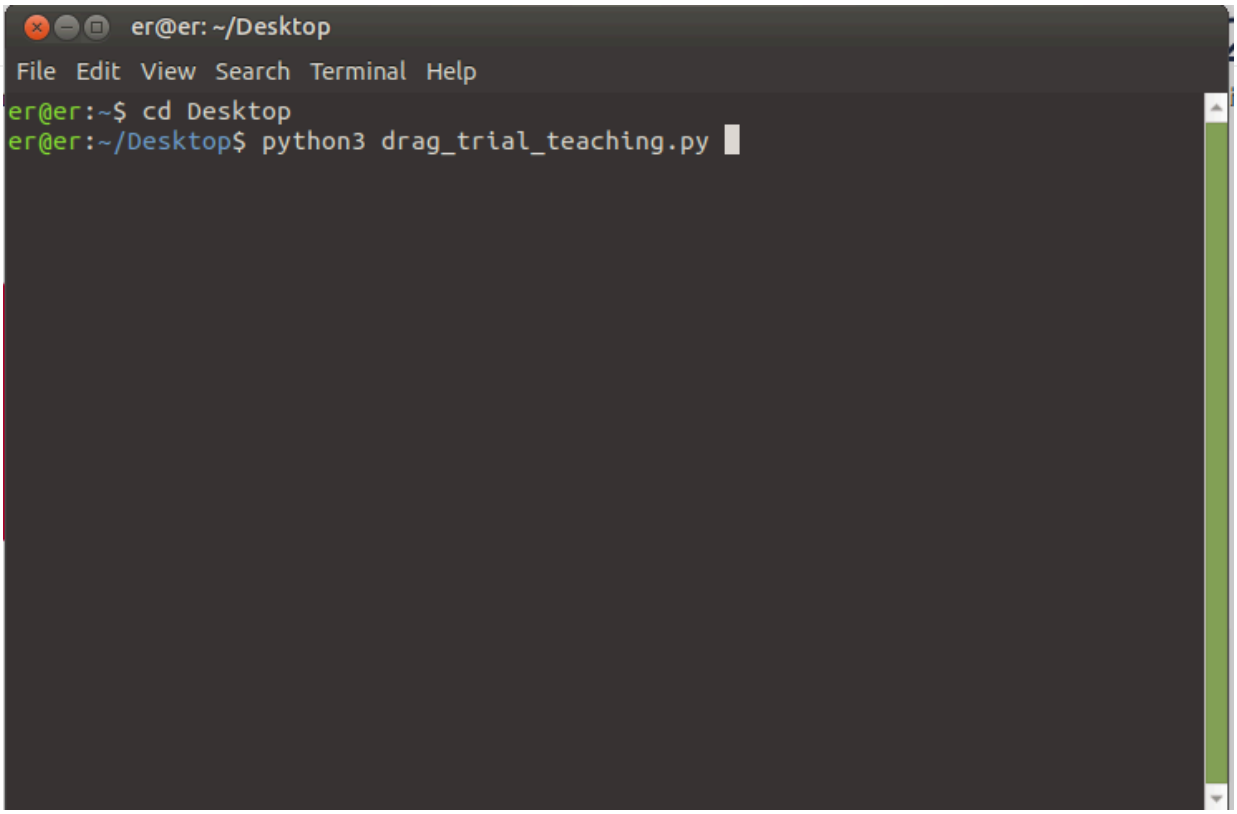
```
                    record = [angles, interval_time]
                    self.record_list.append(record)
                    print("\r {}".format(time.time() - start_t), end="")
            else:
                angles = self.mc.get_encoders()
                speeds = self.mc.get_servo_speeds()
                interval_time = time.time() - start_t
                if angles and speeds:
                    record = [angles, speeds, interval_time]
                    self.record_list.append(record)
                    print("\r {}".format(time.time() - start_t), end="")

    self.echo("Start recording.")
    self.record_t = threading.Thread(target=_record, daemon=True)
    self.record_t.start()

def stop_record(self):

    if isinstance(self.mc, MyArm):
        self.mc.power_on()
    else:
        self.mc.focus_all_servos()

    if self.recording:
        self.recording = False
        self.record_t.join()
        self.echo("Stop record")

def play(self):
    self.echo("Start play")
    if isinstance(self.mc, (MyArm, MyPalletizer260)):
        for record in self.record_list:
            encoders, interval_time = record
            self.mc.set_encoders(encoders, 100)
            time.sleep(interval_time)
    else:
        i = 0
        for record in self.record_list:
            encoders, speeds, interval_time = record
            self.mc.set_encoders_drag(encoders, speeds)
            if i == 0:
                time.sleep(3)
            i += 1
            time.sleep(interval_time)
    self.echo("Finish play")

def loop_play(self):
    self.playing = True

    def _loop():
```

```
            while self.playing:
                self.play()

        self.echo("Start loop play.")
        self.play_t = threading.Thread(target=_loop, daemon=True)
        self.play_t.start()

    def stop_loop_play(self):
        if self.playing:
            self.playing = False
            self.play_t.join()
            self.echo("Stop loop play.")

    def save_to_local(self):
        if not self.record_list:
            self.echo("No data should save.")
            return
        with open(self.path, "w") as f:
            json.dump(self.record_list, f, indent=2)
            self.echo("save dir:  {}\n".format(self.path))

    def load_from_local(self):
        with open(self.path, "r") as f:
            try:
                data = json.load(f)
                self.record_list = data
                self.echo("Load data success.")
            except Exception:
                self.echo("Error: invalid data.")

    def print_menu(self):
        print(
            """\
        \r q: quit
        \r r: start record
        \r c: stop record
        \r p: play once
        \r P: loop play / stop loop play
        \r s: save to local
        \r l: load from local
        \r f: release mycobot
        \r----------------------------------
            """
        )

    def start(self):
        self.print_menu()

        while not False:
            with Raw(sys.stdin):
```

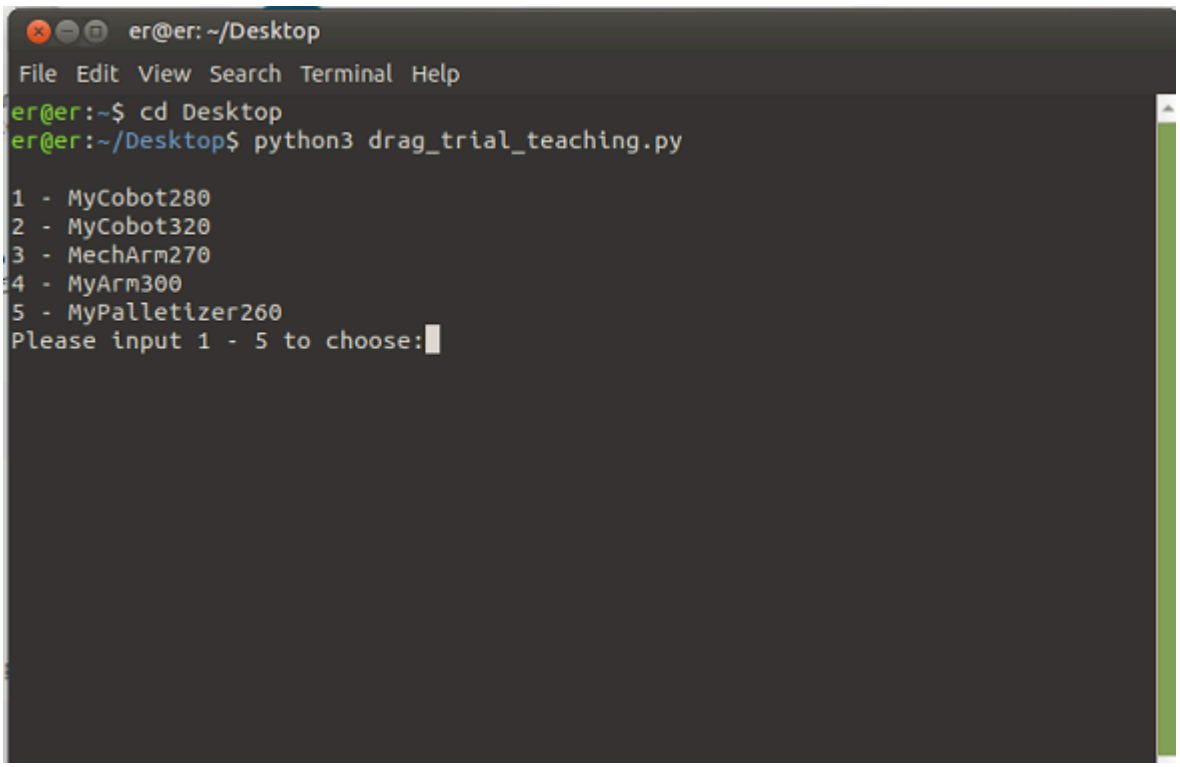
```
                key = sys.stdin.read(1)
                if key == "q":
                    break
                elif key == "r":  # recorder
                    self.record()
                elif key == "c":  # stop recorder
                    self.stop_record()
                elif key == "p":  # play
                    if not self.playing:
                        self.play()
                    else:
                        print("Already playing. Please wait till current play stop or stop loop play.")
                elif key == "P":  # loop play
                    if not self.playing:
                        self.loop_play()
                    else:
                        self.stop_loop_play()
                elif key == "s":  # save to local
                    self.save_to_local()
                elif key == "l":  # load from local
                    self.load_from_local()
                elif key == "f":  # free move
                    if isinstance(self.mc, MyCobot320):
                        self.mc.release_all_servos(1)
                    else:
                        self.mc.release_all_servos()
                    self.echo("Released")
                else:
                    print(key)
                    continue


if __name__ == "__main__":
    setup()
    recorder = TeachingTest(mc)
    recorder.start()
```

Step 3: Open the terminal (shortcut key CTRL+ALT+t) and enter the following command:

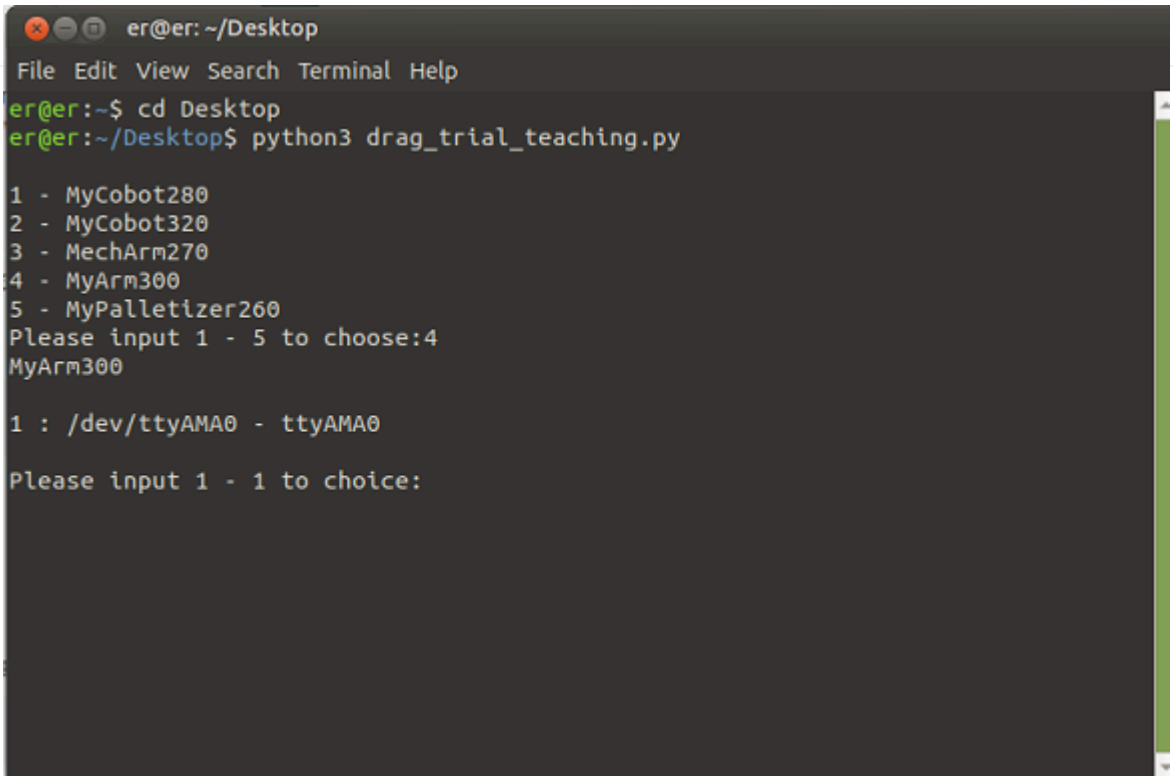
```
cd Desktop
python3 drag_trial_teaching.py
```



Step 4: Select the model number `Please input 1 - 5 to choose:` , enter 4 here and press Enter.

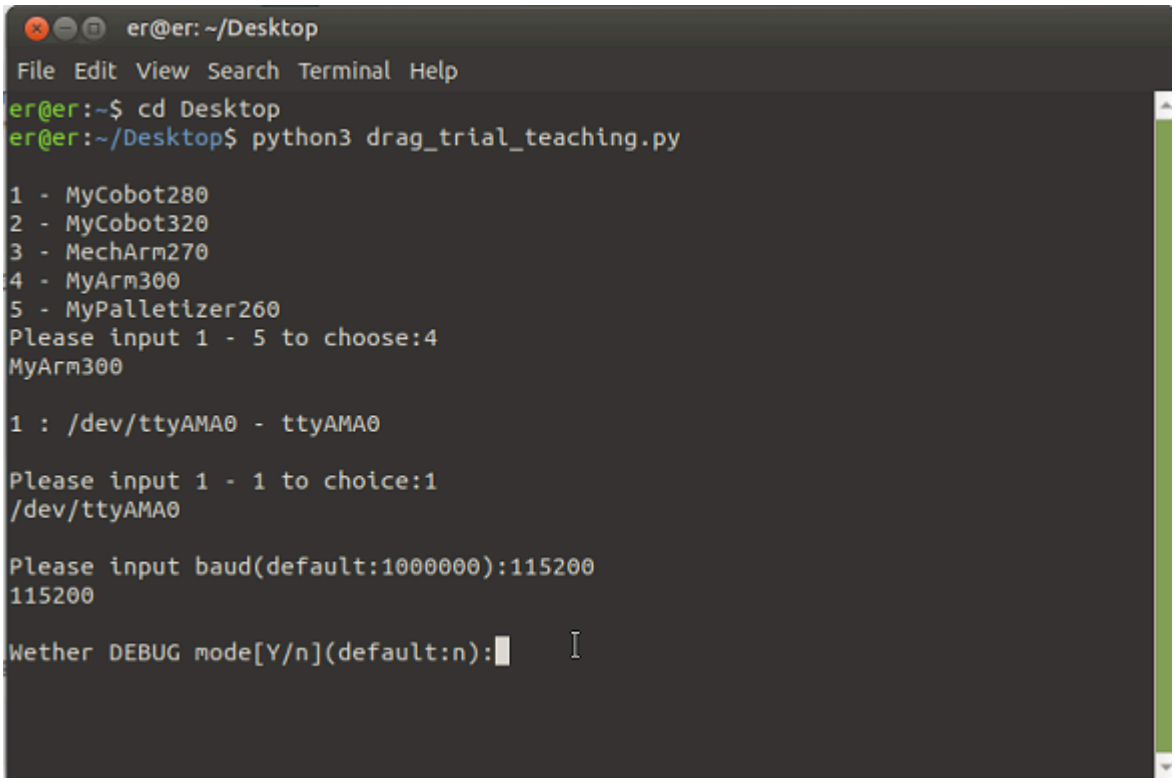


Step 5: Press Enter and the command `Please input 1 - 1 to choice:` will appear. Enter 1 and press Enter.。

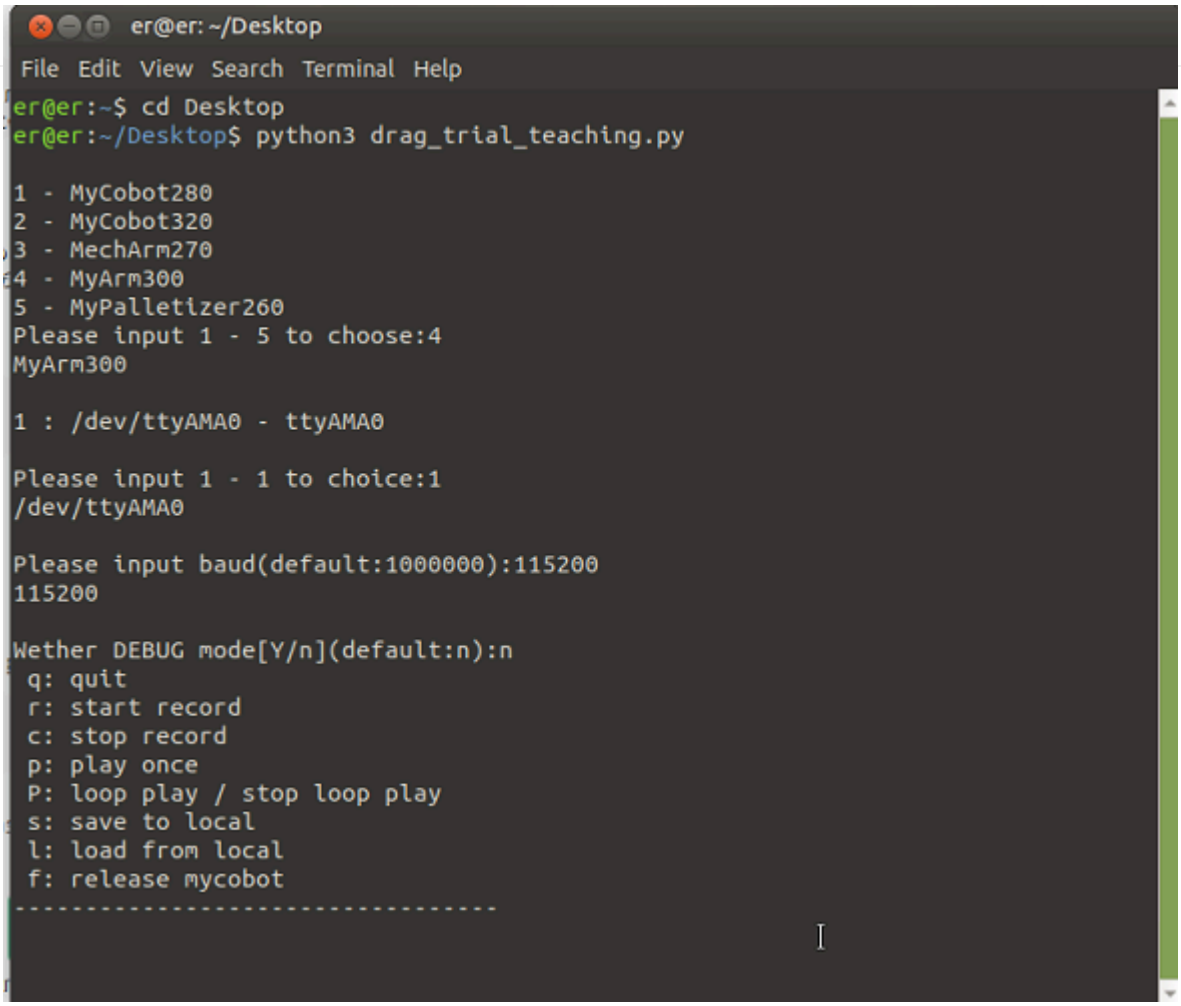


Step 6: Enter the corresponding baud rate and press Enter.

- *myCobot 280-Pi：1000000*
- *myCobot 320-Pi：115200*
- *myCobot 270-Pi：1000000*
- *myArm 300-Pi：115200*
- *myPalletizer 260-Pi: 1000000*



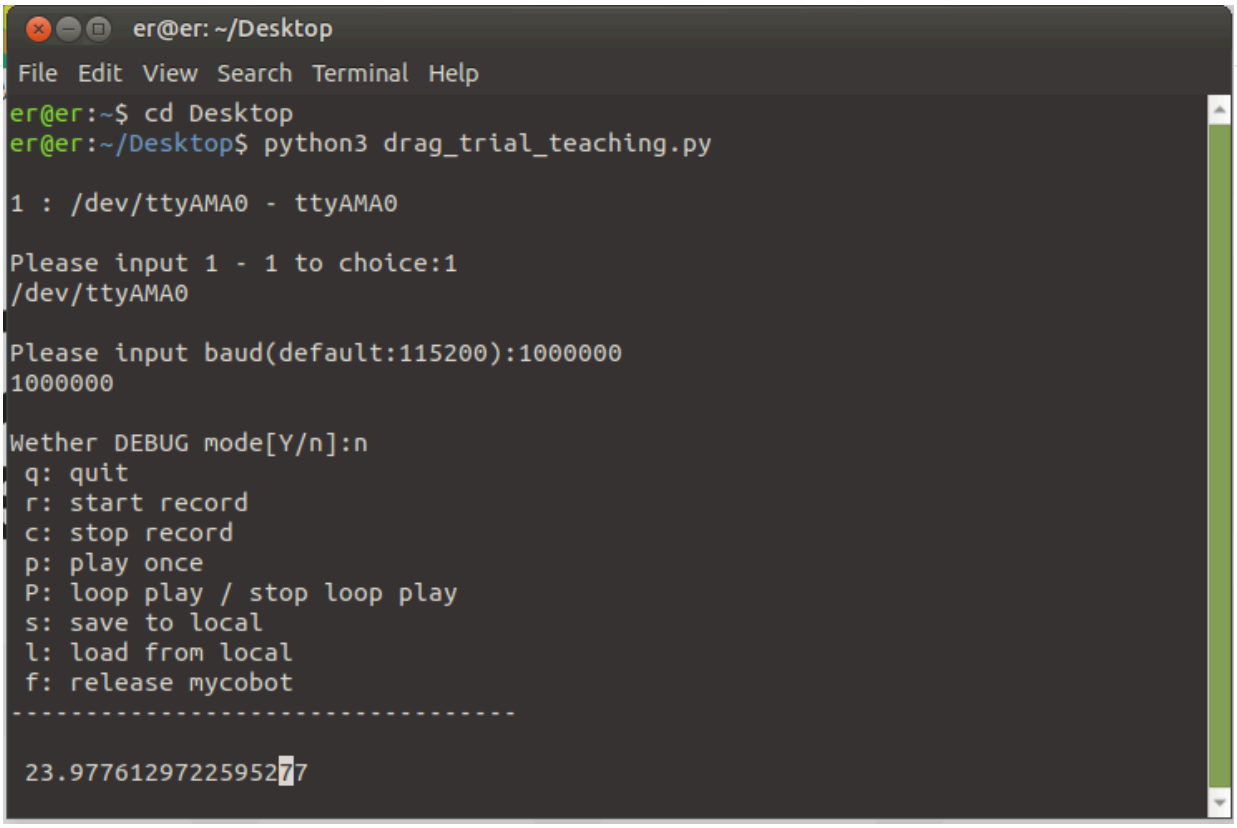
Step 7: Do you want to view the BAUD? Enter Y/N and press Enter.



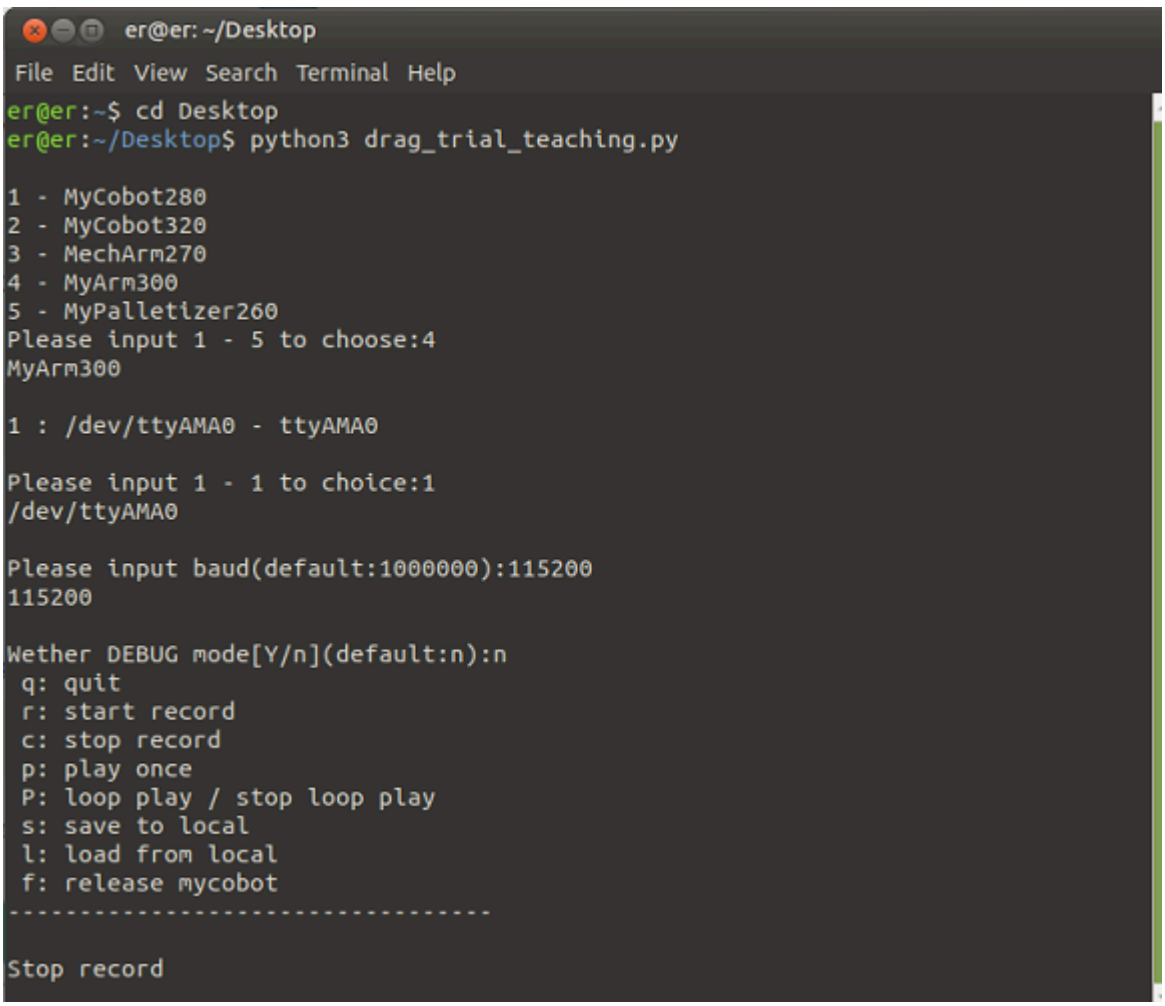
Step 8: Enter `r` on the keyboard to start recording. Now you can start dragging the robotic arm.

- *Type q on the keyboard to exit this program*

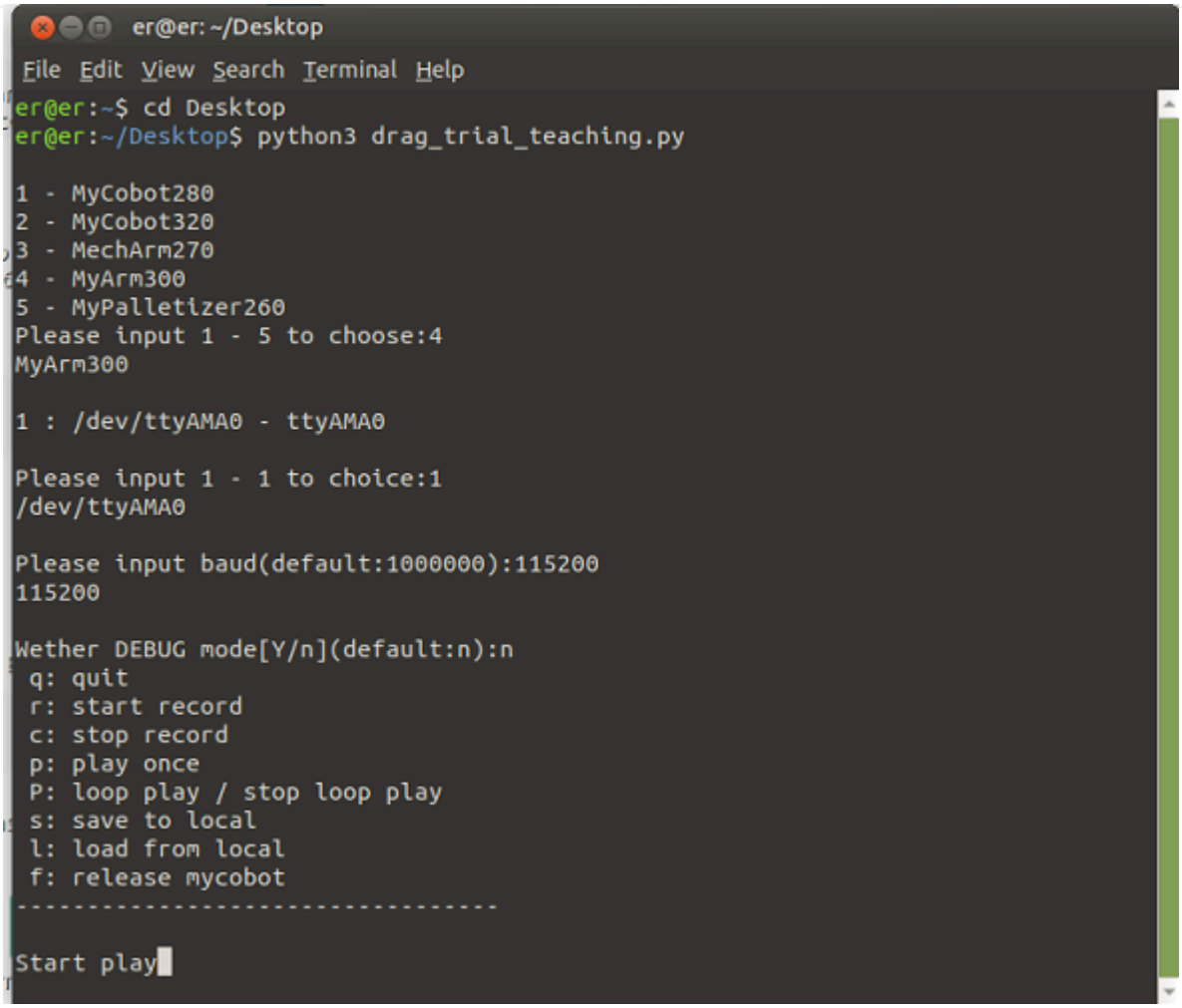
r is entered here



Step 9: Input c on the keyboard to stop recording



Step 10: Input p (Lowercase letters) on the keyboard to play once.



- Input P (Uppercase letters) to play in a loop / Stop Loop Play**
- Input q to terminate the loop and exit the program*
- Input f to release each joint of the robot arm (can be used to stop the robot arm from moving and each joint is locked)*

Implement robot arm calibration

Applicable devices

- myCobot 280 Pi
- myCobot 320 Pi
- mechArm 270 Pi

Operation steps

Step 1: Atom burns the latest version of **atomMain**.

Step 2: Create a new Python file *.py on the desktop, copy the following code into it and save it.

> **Note:** The file is named: rasp_mycobot_test_gui.py.

Github download address

```
#!/usr/bin/env python3
import socket
import tkinter
from tkinter import ttk
import time
import threading
import os
import textwrap
import serial
import serial.tools.list_ports

from pymycobot.mycobot import MyCobot
from pymycobot import PI_PORT, PI_BAUD



LOG_NUM = 0



class MycobotTest(object):
    def __init__(self):
        self.mycobot = None

        self.win = tkinter.Tk()
        self.win.title("Mycobot Testing Tool for Raspberry Pi")
        self.win.geometry("918x511+10+10")  #  defines the default display position when the window pops up

        self.port_label = tkinter.Label(self.win, text="Select the serial port:")
        self.port_label.grid(row=0)
        self.port_list = ttk.Combobox(
            self.win, width=15, postcommand=self.get_serial_port_list
        )  # #Creating a Drop-Down Menu
        self.get_serial_port_list()  # #Set a value for the drop-down menu
        self.port_list.current(0)
        self.port_list.grid(row=0, column=1)

        self.baud_label = tkinter.Label(self.win, text="Select the baud rate:")
        self.baud_label.grid(row=1)
        self.baud_list = ttk.Combobox(self.win, width=15)
        self.baud_list["value"] = ("115200", "1000000")
        self.baud_list.current(0)
        self.baud_list.grid(row=1, column=1)

        # Connect
        self.connect_label = tkinter.Label(self.win, text="Connect mycobot:")
        self.connect_label.grid(row=2)
        self.connect = tkinter.Button(self.win, text="connect", command=self.connect_mycobot)
        self.disconnect = tkinter.Button(
            self.win, text="disconnect", command=self.disconnect_mycobot
        )
        self.connect.grid(row=3)
```

```
        self.disconnect.grid(row=3, column=1)

        # Check servo.
        self.check_label = tkinter.Label(self.win, text="Detect connection:")
        self.check_label.grid(row=4)
        self.check_btn = tkinter.Button(
            self.win, text="Start detection", command=self.check_mycobot_servos
        )
        self.check_btn.grid(row=4, column=1)

        # Calibration.
        self.calibration_num = None
        self.calibration_label = tkinter.Label(self.win, text="Calibrate the servos:")
        self.calibration_label.grid(row=5)
        self.calibration_btn = tkinter.Button(
            self.win, text="Start calibration", command=self.calibration_mycobot
        )
        self.calibration_btn.grid(row=5, column=1)

        # LED.
        self.set_color_label = tkinter.Label(self.win, text="Testing the Atom Light Board:")
        self.set_color_label.grid(row=6, columnspan=2)
        self.color_red = tkinter.Button(
            self.win, text="Set Red", command=lambda: self.send_color("red")
        )
        self.color_green = tkinter.Button(
            self.win, text="Set Green", command=lambda: self.send_color("green")
        )
        self.color_red.grid(row=7)
        self.color_green.grid(row=7, column=1)

        # Aging test.
        self.aging_stop = False
        self.movement_label = tkinter.Label(self.win, text="Aging cycle action:")
        self.movement_label.grid(row=8)
        self.start_btn = tkinter.Button(
            self.win, text="start", command=self.start_aging_test
        )
        self.start_btn.grid(row=9)
        self.stop_btn = tkinter.Button(
            self.win, text="stop", command=self.stop_aging_test
        )
        self.stop_btn.grid(row=9, column=1)

        # Release
        self.release_btn = tkinter.Button(
            self.win, text="Relax all motors", command=self.release_mycobot
        )
        self.release_btn.grid(row=10)
```

```
        # rectify
        self.rectify_btn = tkinter.Button(
            self.win, text="Calibrate pids", command=self.rectify_mycobot
        )
        self.rectify_btn.grid(row=10, column=1)

        # Log output.
        self.log_label = tkinter.Label(self.win, text="log:")
        self.log_label.grid(row=0, column=12)
        _f = tkinter.Frame(self.win)
        _bar = tkinter.Scrollbar(_f, orient=tkinter.VERTICAL)
        self.log_data_Text = tkinter.Text(
            _f, width=100, height=35, yscrollcommand=_bar.set
        )
        _bar.pack(side=tkinter.RIGHT, fill=tkinter.Y)
        _bar.config(command=self.log_data_Text.yview)
        self.log_data_Text.pack()
        # self.log_data_Text.grid(row=1, column=12, rowspan=15, columnspan=10)
        _f.grid(row=1, column=12, rowspan=15, columnspan=10)

    def run(self):
        self.win.mainloop()  # run

    # ==========================================================
    # Connect method
    # ==========================================================
    def connect_mycobot(self):
        self.prot = port = self.port_list.get()
        if not port:
            self.write_log_to_Text("Please select the serial port")
            return
        self.baud = baud = self.baud_list.get()
        if not baud:
            self.write_log_to_Text("Please select the baud rate")
            return
        baud = int(baud)

        try:
            # self.mycobot = MyCobot(PI_PORT, PI_BAUD)
            self.mycobot = MyCobot(port, baud)
            # self.mycobot = MyCobot("/dev/cu.usbserial-0213245D", 115200)
            self.write_log_to_Text("connection succeeded !")
        except Exception as e:
            err_log = """\
                \rConnection failed !!!
                \r=================================================
                {}
                \r=================================================
            """.format(
                e
```

```
            )
            self.write_log_to_Text(err_log)

    def disconnect_mycobot(self):
        if not self.has_mycobot():
            return

        try:
            del self.mycobot
            self.mycobot = None
            self.write_log_to_Text("Disconnected successfully!")
        except AttributeError:
            self.write_log_to_Text("Mycobot is not connected yet!!!")

    # ============================================================
    #  Function method
    # ============================================================
    def release_mycobot(self):
        if not self.has_mycobot():
            return
        self.mycobot.release_all_servos()
        self.write_log_to_Text("Release over.")

    def check_mycobot_servos(self):
        if not self.has_mycobot():
            return

        ping_commands = [
            [255, 255, 1, 2, 1, 251],
            [255, 255, 2, 2, 1, 250],
            [255, 255, 3, 2, 1, 249],
            [255, 255, 4, 2, 1, 248],
            [255, 255, 5, 2, 1, 247],
            [255, 255, 6, 2, 1, 246],
            [255, 255, 7, 2, 1, 246],
        ]
        res = []
        for idx, command in enumerate(ping_commands, start=1):
            self.mycobot._write(command)
            time.sleep(0.1)
            if not self.mycobot._read(1):
                res.append(idx)
            time.sleep(0.1)

        if res:
            self.write_log_to_Text("Joint {} cannot communicate!!!".format(res))
        else:
            self.write_log_to_Text("All joints are connected normally.")

    def calibration_mycobot(self):
```

```
        """Calibration button click event.
        Click to calibrate one motor at a time and calibrate in turn. After all
        calibration, resume initialization.
        """
        if not self.has_mycobot():
            return

        if not self.calibration_num:
            self.calibration_num = 0

        self.calibration_num += 1

        self.mycobot.set_servo_calibration(self.calibration_num)
        time.sleep(0.1)
        self.mycobot.send_angle(self.calibration_num, 0, 0)
        time.sleep(0.1)
        self.write_log_to_Text("Calibration of motor %s completed." % self.calibration_num)

        if self.calibration_num == 6:
            self.write_log_to_Text("All calibrations are completed.")
            self.calibration_num = None
            self.rectify_mycobot()
            self._calibration_test()

    def send_color(self, color: str):
        if not self.has_mycobot():
            return

        color_dict = {
            "red": [255, 0, 0],
            "green": [0, 255, 0],
            "blue": [0, 0, 255],
        }
        self.mycobot.set_color(*color_dict[color])
        self.write_log_to_Text("Send color: {}.".format(color))

    def start_aging_test(self):
        if not self.has_mycobot():
            return

        self.aging_stop = False
        self.aging = threading.Thread(target=self._aging_test, daemon=True)
        self.aging.start()
        # self._aging_test()
        self.write_log_to_Text("Start cyclic aging test ...")

    def stop_aging_test(self):
        try:
            os.system("sudo systemctl stop aging_test.service")
            os.system("sudo rm /home/pi/aging_test.sh")
```

```
            os.system("sudo rm /home/pi/Desktop/aging_test.py")
            os.system("sudo rm /etc/systemd/system/aging_test.service")
            os.system("sudo systemctl daemon-reload")
            self.write_log_to_Text("End of cycle aging test.")
        except:
            self.write_log_to_Text("End of aging test failure!!!")

    def rectify_mycobot(self):
        if not self.has_mycobot():
            return

        for i in range(1, 7):
            self.mycobot.set_servo_data(i, 24, 0)
            time.sleep(0.1)
            self.mycobot.set_servo_data(i, 26, 3)
            time.sleep(0.1)
            self.mycobot.set_servo_data(i, 27, 3)
            time.sleep(0.1)
        time.sleep(0.1)
        for i in range(1, 7):
            self.write_log_to_Text(
                "Read servo {} pid data, 24:{}, 26:{}, 27:{}.".format(
                    i,
                    self.mycobot.get_servo_data(i, 24),
                    self.mycobot.get_servo_data(i, 26),
                    self.mycobot.get_servo_data(i, 27),
                )
            )
            time.sleep(0.1)

    # ============================================================
    # Utils method
    # ============================================================
    def has_mycobot(self):
        """Check whether it is connected on mycobot"""
        if not self.mycobot:
            self.write_log_to_Text("Mycobot is not connected yet!!!")
            return False
        return True

    def _aging_test(self):
        """
        Aging test thread target.
        By using in `start_aging_test()` and `stop_aging_test()`.
        """
        # if socket.gethostname() != "pi":
        #     self.write_log_to_Text("Burn-in test supports Raspberry OS.")
        #     return

        aging_test_content_py = textwrap.dedent(
```

```
"""\
#!/usr/bin/python3
from pymycobot.mycobot import MyCobot
from pymycobot import PI_PORT, PI_BAUD
import time
mycobot = MyCobot('%s', %s)
def aging_test():
    # fast
    mycobot.set_color(255, 0, 0)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([170, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([-170, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 90, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, -90, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 140, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, -140, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 130, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, -110, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 165, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, -165, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 0], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 180], 95)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, -180], 95)
    # middle
    mycobot.set_color(0, 255, 0)
    mycobot.wait(3).send_angles([0, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([170, 0, 0, 0, 0, 0], 55)
    mycobot.wait(6.5).send_angles([-170, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 90, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, -90, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 140, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, -140, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 130, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, -110, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 165, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, -165, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 180], 55)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, -180], 55)
    # slow
    mycobot.set_color(0, 0, 255)
    mycobot.wait(5).send_angles([0, 0, 0, 0, 0, 0], 15)
```

```
            mycobot.wait(7).send_angles([170, 0, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([-170, 0, 0, 0, 0, 0], 15)
            mycobot.wait(11).send_angles([0, 0, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 90, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, -90, 0, 0, 0, 0], 15)
            mycobot.wait(0).send_angles([0, 0, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 0, 140, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 0, -140, 0, 0, 0], 15)
            mycobot.wait(11).send_angles([0, 0, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 0, 0, 130, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 0, 0, -110, 0, 0], 15)
            mycobot.wait(11).send_angles([0, 0, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 0, 0, 0, 165, 0], 15)
            mycobot.wait(7).send_angles([0, 0, 0, 0, -165, 0], 15)
            mycobot.wait(11).send_angles([0, 0, 0, 0, 0, 0], 15)
            mycobot.wait(7).send_angles([0, 0, 0, 0, 0, 180], 15)
            mycobot.wait(7).send_angles([0, 0, 0, 0, 0, -180], 15)
        if __name__ == '__main__':
            while True:
                aging_test()
        """
        % (self.prot, self.baud)
    )

    aging_test_content_sh = textwrap.dedent(
        """\
        #!/bin/bash
        /usr/bin/python3 /home/pi/Desktop/aging_test.py
        """
    )

    aging_test_content_service = textwrap.dedent(
        """\
        [Unit]
        Description=aging-test
        [Service]
        Type=forking
        User=pi
        Restart=on-failure
        RestartSec=2
        ExecStart=/home/pi/aging_test.sh
        [Install]
        WantedBy=multi-user.target
        """
    )

    os.system(
        'echo "' + aging_test_content_py + '" >> /home/pi/Desktop/aging_test.py'
    )
    os.system('echo "' + aging_test_content_sh + '" >> /home/pi/aging_test.sh')
```

```
        os.system("sudo chmod +x /home/pi/aging_test.sh")
        os.system(
            'echo "'
            + aging_test_content_service
            + '" >> /home/pi/Desktop/aging_test.service'
        )
        os.system(
            "sudo mv /home/pi/Desktop/aging_test.service /etc/systemd/system/aging_test.service"
        )
        os.system("sudo systemctl enable aging_test.service")
        os.system("sudo systemctl start aging_test.service")

    def _calibration_test(self):
        self.write_log_to_Text("Start test calibration.")
        angles = [0, 0, 0, 0, 0, 0]
        test_angle = [-20, 20, 0]
        for i in range(6):
            for j in range(3):
                angles[i] = test_angle[j]
                self.mycobot.send_angles(angles, 0)
                time.sleep(0.7)
        self.write_log_to_Text("The test calibration is completed.")

    def get_serial_port_list(self):
        plist = [
            str(x).split(" - ")[0].strip() for x in serial.tools.list_ports.comports()
        ]
        print(plist)
        self.port_list["value"] = plist
        return plist

    def get_current_time(self):
        """Get current time with format."""
        current_time = time.strftime("%Y-%m-%d %H:%M:%S", time.localtime(time.time()))
        return current_time

    def write_log_to_Text(self, logmsg: str):
        global LOG_NUM
        current_time = self.get_current_time()
        logmsg_in = str(current_time) + " " + str(logmsg) + "\n"

        if LOG_NUM <= 18:
            self.log_data_Text.insert(tkinter.END, logmsg_in)
            LOG_NUM += len(logmsg_in.split("\n"))
            # print(LOG_NUM)
        else:
            self.log_data_Text.insert(tkinter.END, logmsg_in)
            self.log_data_Text.yview("end")
```

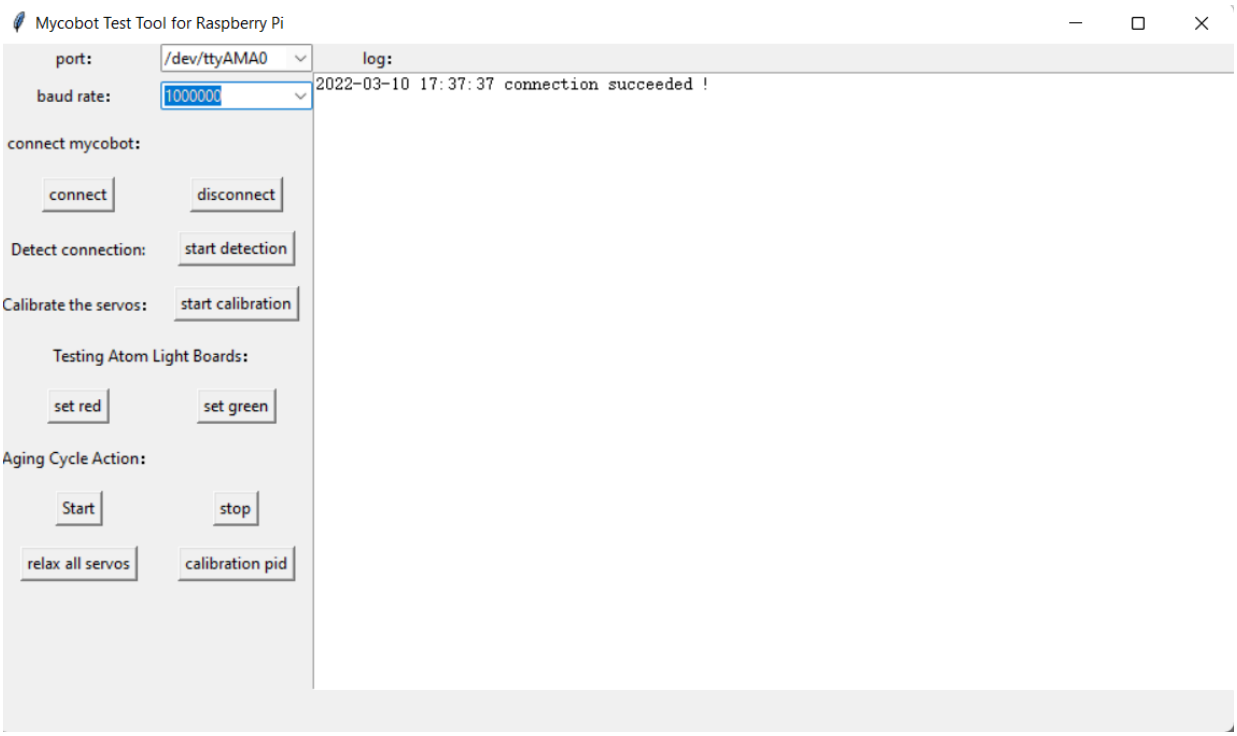
```
if __name__ == "__main__":
    MycobotTest().run()
```

Step 3: Open the terminal (shortcut CTRL+ALT+t), enter the following command, and then press Enter:

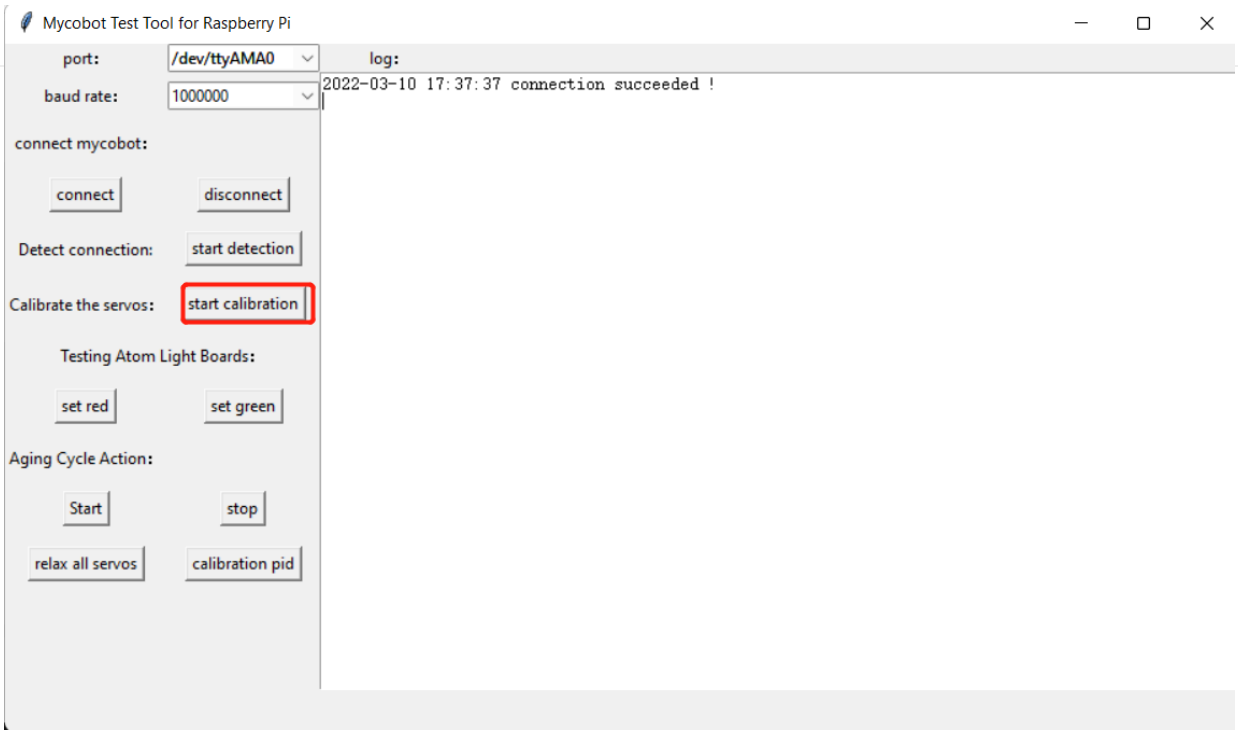
```
cd Desktop
python3 rasp_mycobot_test_gui.py
```

Step 4: Select the corresponding baud rate and click Connect.

- *myCobot 280-Pi: 1000000*
- *myCobot 320-Pi: 115200*



Step 5: Manually return each joint of the robot arm to zero position and click **Start Calibration**. **Calibration End** appears on the interface, and the robot arm calibration is completed.


Mycobot Test Tool for Raspberry Pi
port:
/dev/ttyAMA0
log:
baud rate:
1000000
2022-03-10 17:37:37 connection succeeded !
connect mycobot:
connect
disconnect
Detect connection:
start detection
Calibrate the servos:
start calibration
Testing Atom Light Boards:
set red
set green
Aging Cycle Action:
Start
stop
relax all servos
calibration pid

Implement connection detection

Applicable devices

- myCobot 280 Pi
- myCobot 320 Pi
- mechArm 270 Pi

Operation steps

Step 1: Atom burns the latest version of **atomMain**.

Step 2: Create a new Python file *.py on the desktop, copy the following code into it and save it.

> **Note:** The file is named: myCobot_test_demo_CN.py.

```
from pymycobot.mycobot import MyCobot


LOG_NUM = 0


class MycobotTest(object):
    def __init__(self):
        self.mycobot = None

        self.win = tkinter.Tk()
        self.win.title("Raspberry Pi version of myCobot testing tool")
        self.win.geometry("918x480+10+10")

        self.port_label = tkinter.Label(self.win, text="Select the serial port:")
        self.port_label.grid(row=0)
        self.port_list = ttk.Combobox(
            self.win, width=15, postcommand=self.get_serial_port_list
        )  # #Create a drop-down menu
        self.get_serial_port_list()  # #Set a value for the drop-down menu
        self.port_list.current(0)
        self.port_list.grid(row=0, column=1)

        self.baud_label = tkinter.Label(self.win, text="Select the baud rate:")
        self.baud_label.grid(row=1)
        self.baud_list = ttk.Combobox(self.win, width=15)
        self.baud_list["value"] = ("1000000", "115200")
        self.baud_list.current(1)
        self.baud_list.grid(row=1, column=1)

        # Connect
        self.connect_label = tkinter.Label(self.win, text="Connect mycobot:")
        self.connect_label.grid(row=2)
        self.connect = tkinter.Button(self.win, text="connect", command=self.connect_mycobot)
        self.disconnect = tkinter.Button(
            self.win, text="disconnect", command=self.disconnect_mycobot
        )
        self.connect.grid(row=3)
        self.disconnect.grid(row=3, column=1)

        # Check servo.
        self.check_label = tkinter.Label(self.win, text="Detect connection:")
        self.check_label.grid(row=4)
        self.check_btn = tkinter.Button(
            self.win, text="Start detection", command=self.check_mycobot_servos
        )
        self.check_btn.grid(row=4, column=1)

        # LED.
        self.set_color_label = tkinter.Label(self.win, text="Testing the Atom Light Board:")
        self.set_color_label.grid(row=5, columnspan=2)
        self.color_red = tkinter.Button(
```

```
            self.win, text="Set Red", command=lambda: self.send_color("red")
        )
        self.color_green = tkinter.Button(
            self.win, text="Set Green", command=lambda: self.send_color("green")
        )
        self.color_red.grid(row=6)
        self.color_green.grid(row=6, column=1)

        # Log output.
        self.log_label = tkinter.Label(self.win, text="log: ")
        self.log_label.grid(row=0, column=12)
        _f = tkinter.Frame(self.win)
        _bar = tkinter.Scrollbar(_f, orient=tkinter.VERTICAL)
        self.log_data_Text = tkinter.Text(
            _f, width=100, height=35, yscrollcommand=_bar.set
        )
        _bar.pack(side=tkinter.RIGHT, fill=tkinter.Y)
        _bar.config(command=self.log_data_Text.yview)
        self.log_data_Text.pack()
        # self.log_data_Text.grid(row=1, column=12, rowspan=15, columnspan=10)
        _f.grid(row=1, column=12, rowspan=15, columnspan=10)

    def run(self):
        self.win.mainloop()  # run

    # ============================================================
    # Connect method
    # ============================================================
    def connect_mycobot(self):
        self.prot = port = self.port_list.get()
        if not port:
            self.write_log_to_Text("Please select the serial port")
            return
        self.baud = baud = self.baud_list.get()
        if not baud:
            self.write_log_to_Text("Please select the baud rate")
            return
        baud = int(baud)

        try:
            # self.mycobot = MyCobot(PI_PORT, PI_BAUD)
            self.mycobot = MyCobot(port, baud)
            time.sleep(0.5)
            self.mycobot._write([255,255,3,22,1,250])
            time.sleep(0.5)
            # self.mycobot = MyCobot("/dev/cu.usbserial-0213245D", 115200)
            self.write_log_to_Text("connection succeeded !")
        except Exception as e:
            err_log = """\
                \rConnection failed !!!
```

```
                \r==================================================
                {}
                \r==================================================
            """.format(
                e
            )
            self.write_log_to_Text(err_log)

    def disconnect_mycobot(self):
        if not self.has_mycobot():
            return

        try:
            del self.mycobot
            self.mycobot = None
            self.write_log_to_Text("Disconnected successfully!")
        except AttributeError:
            self.write_log_to_Text("Mycobot is not connected yet!!!")

    # ============================================================
    #  Function method
    # ============================================================

    def check_mycobot_servos(self):
        if not self.has_mycobot():
            return

        res = []
        for i in range(1,8):
            _data = self.mycobot.get_servo_data(i , 5)
            time.sleep(0.02)
            if _data != i:
                res.append(i)
        if res:
            self.write_log_to_Text("Joint {} cannot communicate!!!".format(res))
        else:
            self.write_log_to_Text("All joints are connected normally.")

    def send_color(self, color: str):
        if not self.has_mycobot():
            return

        color_dict = {
            "red": [255, 0, 0],
            "green": [0, 255, 0],
            "blue": [0, 0, 255],
        }
        self.mycobot.set_color(*color_dict[color])
        self.write_log_to_Text("Send color: {}.".format(color))
```

```
    # ============================================================
    # Utils method
    # ============================================================
    def has_mycobot(self):
        """Check whether it is connected on mycobot"""
        if not self.mycobot:
            self.write_log_to_Text("Mycobot is not connected yet!!!")
            return False
        return True

    def get_serial_port_list(self):
        plist = [
            str(x).split(" - ")[0].strip() for x in serial.tools.list_ports.comports()
        ]
        print(plist)
        self.port_list["value"] = plist
        return plist

    def get_current_time(self):
        """Get current time with format."""
        current_time = time.strftime("%Y-%m-%d %H:%M:%S", time.localtime(time.time()))
        return current_time

    def write_log_to_Text(self, logmsg: str):
        global LOG_NUM
        current_time = self.get_current_time()
        logmsg_in = str(current_time) + " " + str(logmsg) + "\n"

        if LOG_NUM <= 18:
            self.log_data_Text.insert(tkinter.END, logmsg_in)
            LOG_NUM += len(logmsg_in.split("\n"))
            # print(LOG_NUM)
        else:
            self.log_data_Text.insert(tkinter.END, logmsg_in)
            self.log_data_Text.yview("end")


if __name__ == "__main__":
    MycobotTest().run()
```

Step 3: Open a control terminal and enter the following command:

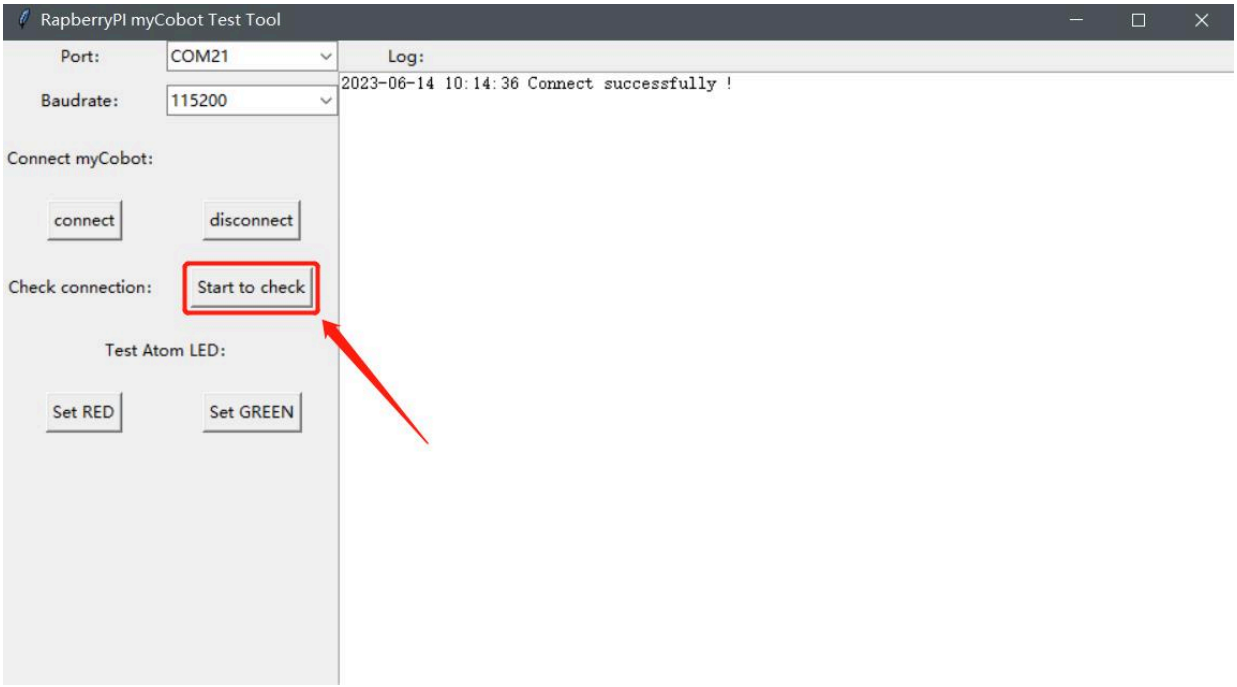
```
cd ~/Desktop/
python3 myCobot_test_demo_CN.py
```

Step 4: Select the baud rate corresponding to the device and click **Connect**.

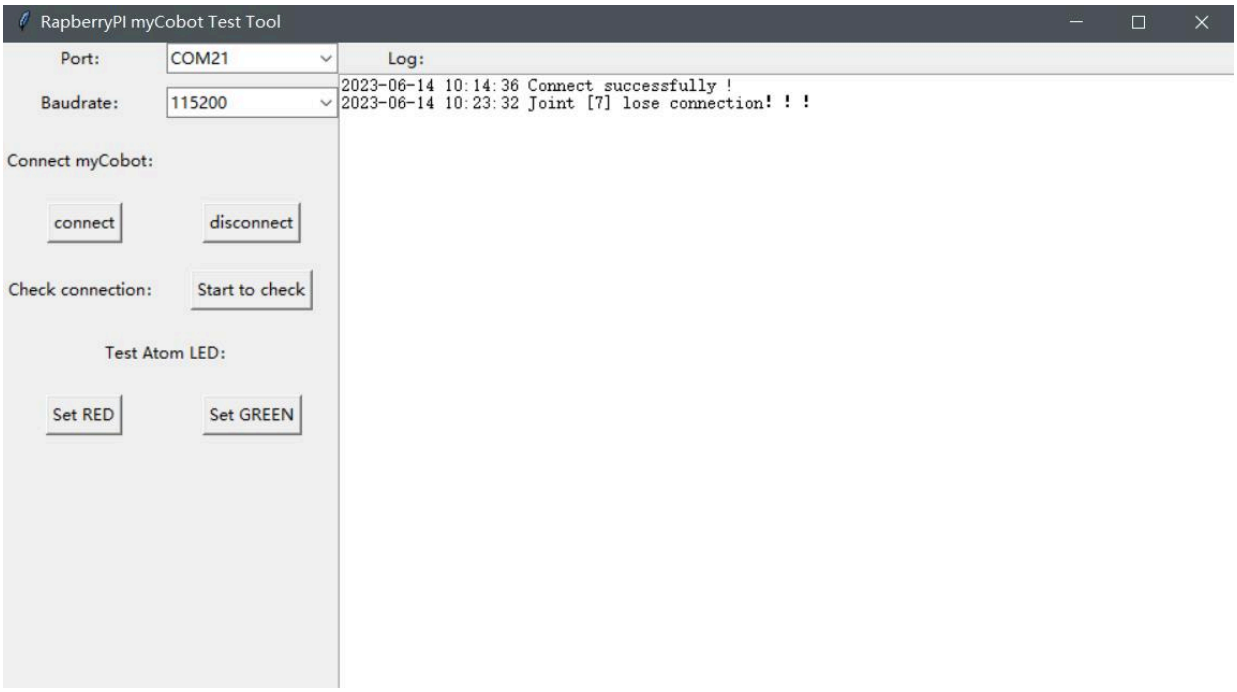
- *myCobot 280-Pi: 1000000*

- *myCobot 320-Pi: 115200*

.jpg)



Step 5: Set each joint of the robot arm to zero position and click **Start detection**.



Step 6: Wait for the interface to show **Joint [7] cannot communicate!** , the robot device detection is normal.

.jpg)

Step 7: The two buttons here can change the color of the Atom LED

.png)

.png)

myStudio

myStudio video tutorial

Original intention of myStudio

- myStudio is a one-stop platform for using robots such as myRobot/myCobot.
- It is convenient for users to select different firmware and download them according to their own usage scenarios, and at the same time learn related teaching materials and browse tutorial videos online.

Latest version of myStudio and supported platforms

- Latest version: V3.5.8
- Applicable to: Windows, Mac, Linux

myStudio functions

- Burn and update firmware
- Provide robot tutorials, such as user manuals, video tutorials, Q&A, etc.
- Information on maintenance and repairs

Applicable devices for myStudio

- myCobot 280

- myCobot 280 M5
- myCobot 280 PI
- myCobot 280 Jetson Nano
- myCobot 280 for Arduino

Firmware version recommendation

Different models of robotic arms require different firmware to be burned. The following are the firmware versions recommended for burning different models of robotic arms.

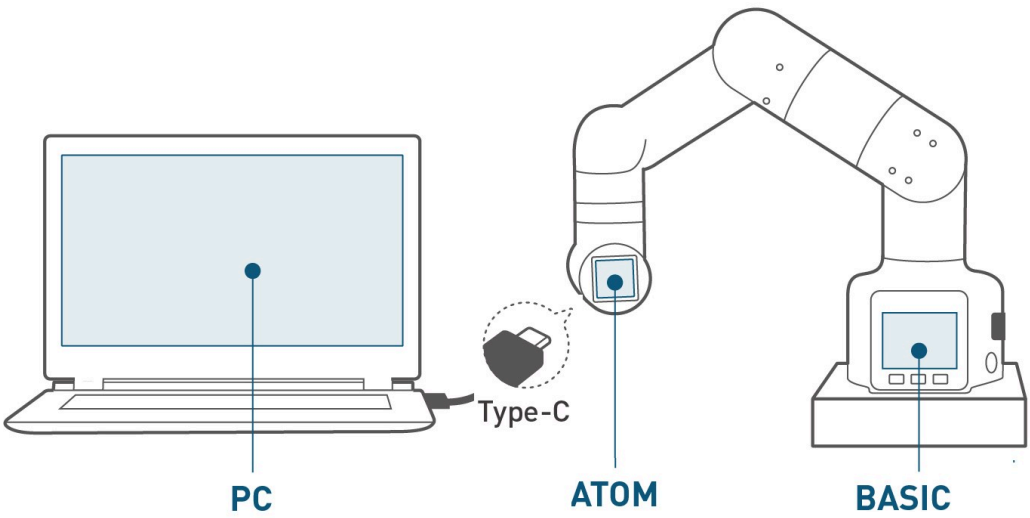
myCobot 280 series

The myCobot 280 series has 4 versions: M5 version, PI version, ardunio version and jetsonnano version. Different versions have different core models, and the firmware and versions required to be burned are also different.

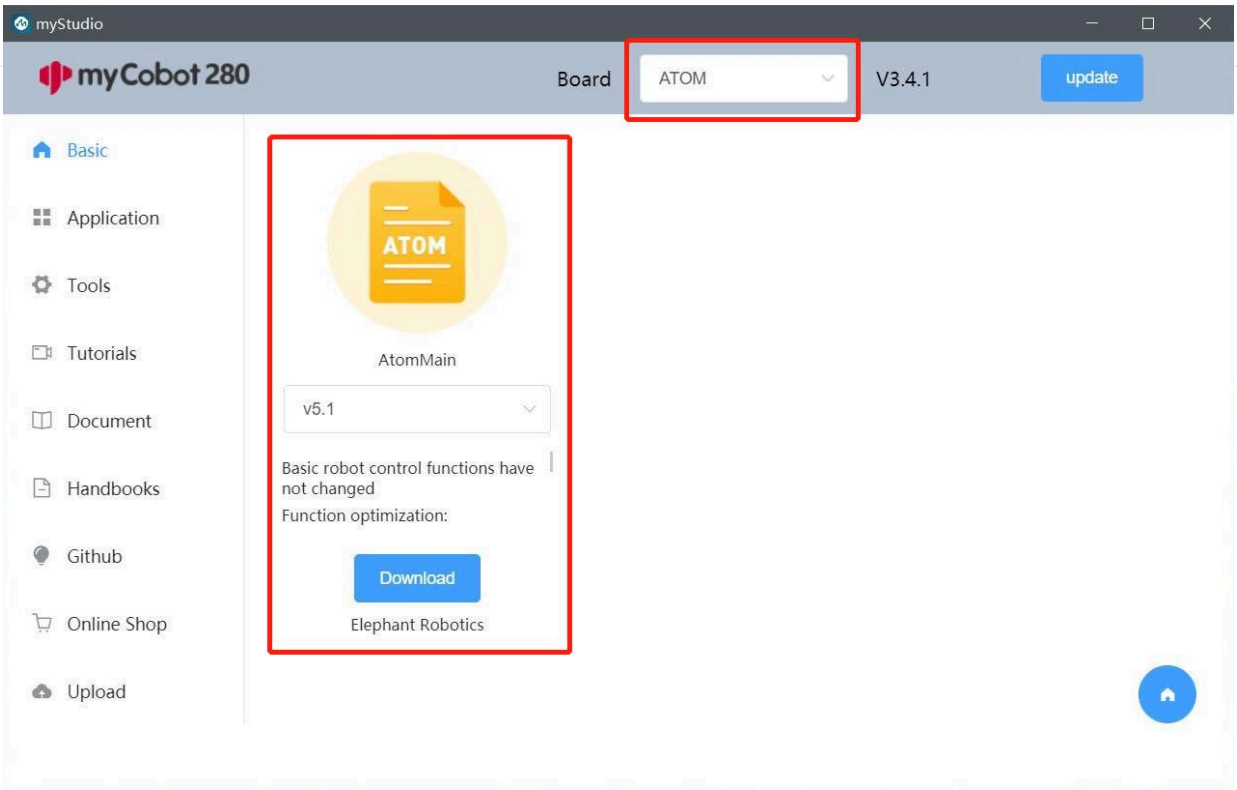
Robot version number	Core	Required firmware to be burned	Recommended firmware and version
PI version	RaspberryPI 4B	ubuntu firmware	Recommend burning V18.04. version
	Atom	atomMain firmware	For products with serial numbers ER28001202200415 and earlier, or products without serial numbers, it is recommended to burn v4.1; for products with serial numbers ER28001202200416 and later, it is recommended to burn v5.1

Update and burn Atom firmware

Step 1: Connect to PC. Use USB to connect the Atom at the end.



Step 2: Select `ATOM` in the `Board` column, and the Atom firmware will appear in the `Basic` sidebar. There is only one Atom firmware, click to burn it (the figure below takes myCobot 280 as an example).


myStudio
myCobot 280
Board
ATOM
V3.4.1
update
Basic
Application
Tools
Tutorials
Document
Handbooks
Github
Online Shop
Upload
ATOM
AtomMain
v5.1
Basic robot control functions have not changed
Function optimization:
Download
Elephant Robotics

Introduction to Motor PID

Modification of the PID parameters can be a trade-off between the control accuracy of the robotic arm and the stability of the movement, we provide two sets of PID parameters, which are suitable for occasions requiring high stability of the movement, and for occasions requiring high precision of the movement.

Applies to PID parameters with smooth motion, where motion accuracy is affected by false positives:

```
'''
This document is applicable to the myCobot 280 series of robotic arms.
The function is to modify the joint motor configuration parameters
and verify the modification results.Please ensure that the robot
control port is not occupied when using it. If you encounter failure,
please run the file again.

#Import dependent library files.
import time
from pymycobot import *

#Define data address and data.

#Define the serial port of the robotic arm, Please check your robot model and fill in the corresponding content.
# _port = '/dev/ttyAMA0'
_port = 'COM30'
_baud = 115200

#Instantiate a hardware serial port.
try:
    mc = MyCobot280(_port, _baud)
except Exception as e:
    print(e)
    print("Error: The current serial port can not be used, please check whether the serial port serial number is correct,
    exit()



#Loop modification and display modification results.
#joint_id = 1 - 6.
for i in range(1,6):
    mc.set_servo_data(i,23,0)
    time.sleep(1)
    print(mc.get_servo_data(i,23))
input("The program ends, please press any key to exit.")
exit()
```

PID parameters suitable for high-precision scenarios will cause the arm to continuously adjust the steady state error:

```
'''
This document is applicable to the myCobot 280 series of robotic arms.
The function is to modify the joint motor configuration parameters
and verify the modification results.Please ensure that the robot
control port is not occupied when using it. If you encounter failure,
please run the file again.

#Import dependent library files.
import time
from pymycobot import *

#Define data address and data.

#Define the serial port of the robotic arm, Please check your robot model and fill in the corresponding content.
# _port = '/dev/ttyAMA0'
_port = 'COM30'
_baud = 115200

#Instantiate a hardware serial port.
try:
    mc = MyCobot280(_port, _baud)
except Exception as e:
    print(e)
    print("Error: The current serial port is not available, please check whether the serial port serial number is correct
    exit()



#Loop modification and display modification results.
#joint_id = 1 - 6.
for i in range(1,6):
    mc.set_servo_data(i,23,4)
    time.sleep(1)
    print(mc.get_servo_data(i,23))
input("The program ends, please press any key to exit.")
exit()
```

Chapter 6 Software Development Guide

Usage Environment

The mycobot 280 pi version does not require a PC, laptop or other devices. You can connect a monitor to develop applications (**Tip⚠: Please use the HDMI cable shipped with the robot to connect the monitor and use the built-in system for development**.

Development Environment

In order to meet the diverse application needs of robots in different scenarios, we have adapted the robot to multiple programming languages. So far, we have adapted the following mainstream programming languages, and we believe that you can use any of the following languages for development. Please be sure to follow the instructions strictly. Any omitted steps may cause the corresponding language to fail to run successfully. I wish you a smooth use of the robot.

Our robots support Python, and the development of the Python API library is also becoming more and more perfect. The robot's joint angles, coordinates, grippers and other aspects can be controlled by Python.

ROS (Robot Operating System) is an open source robot operating system that provides unlimited possibilities for robot development and control. Our robot can control the robot in a modular way through the rich control functions of ROS. Whether it is joint control, path planning or perception feedback, ROS provides corresponding tools and libraries to make the control process more flexible and efficient.

ROS 2 (Robot Operating System 2) is a flexible software framework designed for robot software development. Our robot can make application development more efficient and modular through a series of services and functions such as hardware abstraction, device drivers, library functions, visualization tools, messaging, and package management.

If you have a certain understanding of information theory, coding and robot communication functions, then you should understand that all communications are derived from data transmission. In order to facilitate users to operate the robot, we have opened a communication protocol based on serial communication. You can use the serial assistant or encapsulate it into any programming language you are familiar with to control the robot.

6.5 Blockly myBlockly is a puzzle-style programming software developed by the R&D team of Shenzhen Elephant Robot Company, based on the python environment and the pymycobot dependency library, which allows users to program and control the mycobot robot in a building block-style way.

← Previous Chapter | Next Chapter →

What is Python?

Our products are very friendly to Python, and the development of Python API library is also improving day by day. Through Python, the robot's joint angles, coordinates, grippers and other aspects can be controlled. There are many options. If you want to control our robot arm through Python programming, you can learn this chapter.

Python was designed by Guido van Rossum of the Netherlands Institute for Mathematical and Computer Science Research in the early 1990s as a replacement for a language called ABC.

Python provides efficient high-level data structures and simple and effective object-oriented programming.

Python syntax and dynamic typing, as well as the nature of interpreted languages, make it a programming language for writing scripts and rapidly developing applications on most platforms. With the continuous update of versions and the addition of new language functions, it is gradually used for the development of independent and large projects.

Python interpreter is easy to extend, and can be extended with new functions and data types using C or C++ (or other languages that can be called from C).

Python can also be used as an extension language in customizable software. **Python** has a rich standard library that provides source code or machine code for all major system platforms.

Python development and use guide

You can use Python to develop our robot arm according to the following guidelines

1. Environment construction
2. API description
3. Joint control
4. Coordinate control
5. IO control
6. Gripper control
7. TCP&IP
8. Handle control
9. Drawing patterns
10. Demonstration code and video

Environment setup

pymycobot is a Python package for serial communication with myCobot, supporting Python2, Python3.5 and later versions. Before using pymycobot to control the robot arm, you need to build a Python environment. The following is a detailed description of Python download and installation.

The mycobot 280pi robot arm has a built-in python environment. You can write python code in the Ubuntu system of the 280pi, or you can write a python program in your own PC, and copy the written python program to the Ubuntu system of the robot arm with a USB flash drive for running. The python environment of the robot arm can be checked by the following method

Check the python package:

Open the terminal, enter

```
pip list
```

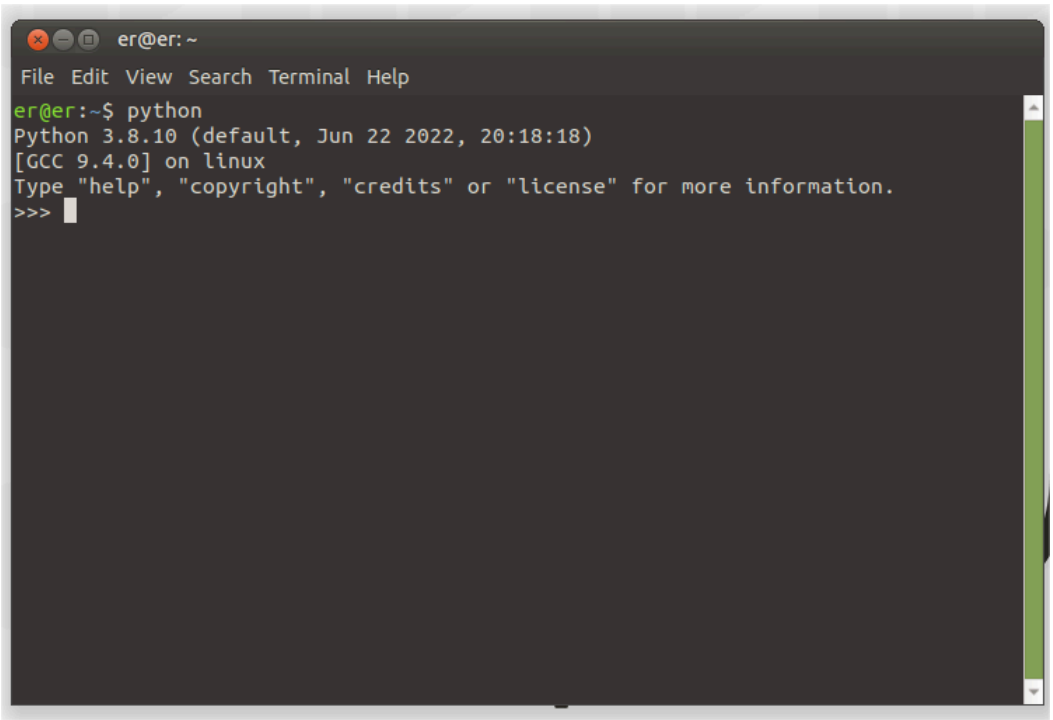
Then press the enter key to view all the packages currently installed in the python environment.

Enter

```
python --version
```

in the terminal to query the python version currently used by the robot arm.

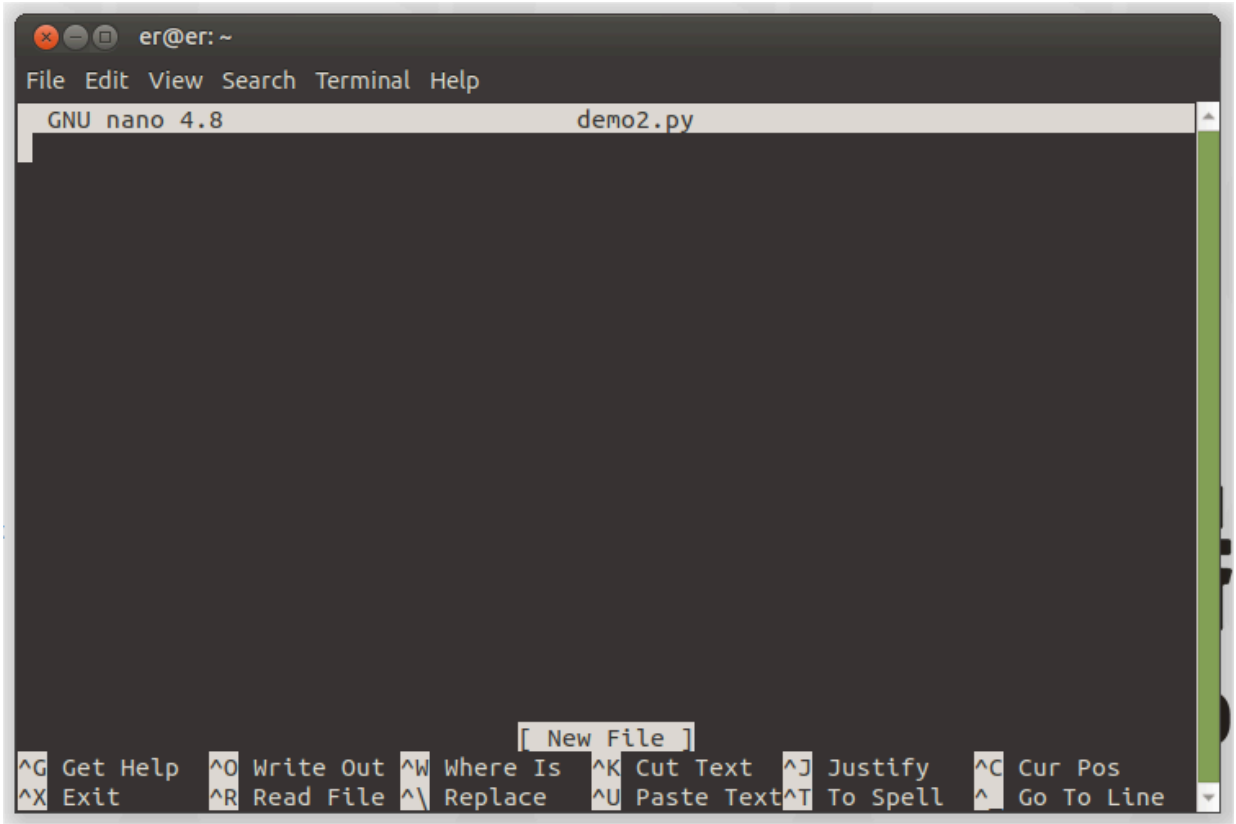
Enter python in the terminal, then press Enter. When `>>>` is displayed, it means that the python compilation environment has been entered, and you can use python to write code at this time.

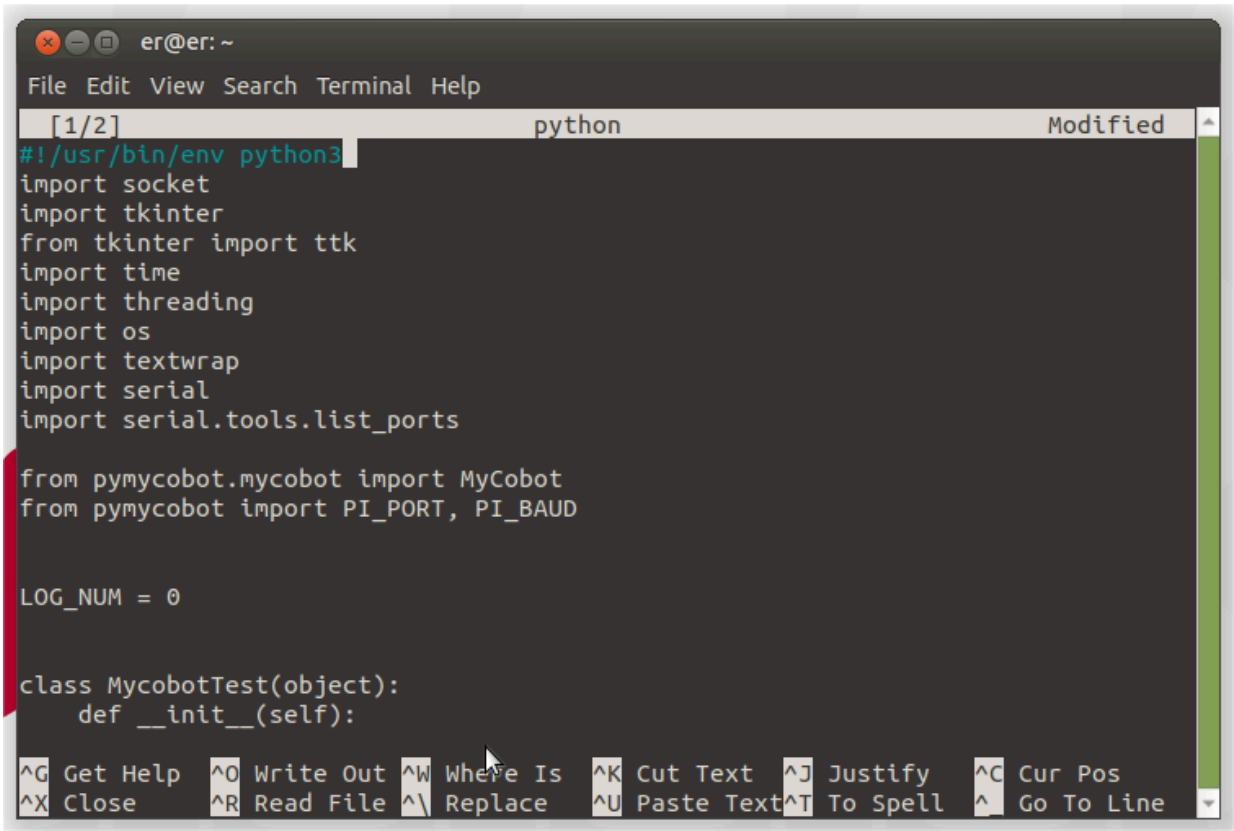


You can also use the nano command to create a python file. First open the terminal, enter

```
nano demo.py
```

Then press Enter to create a python file named demo. Here demo is the file name of the created python file, you can change it to any name here. After pressing Enter, you will enter the code editing page, where you can write python program code.



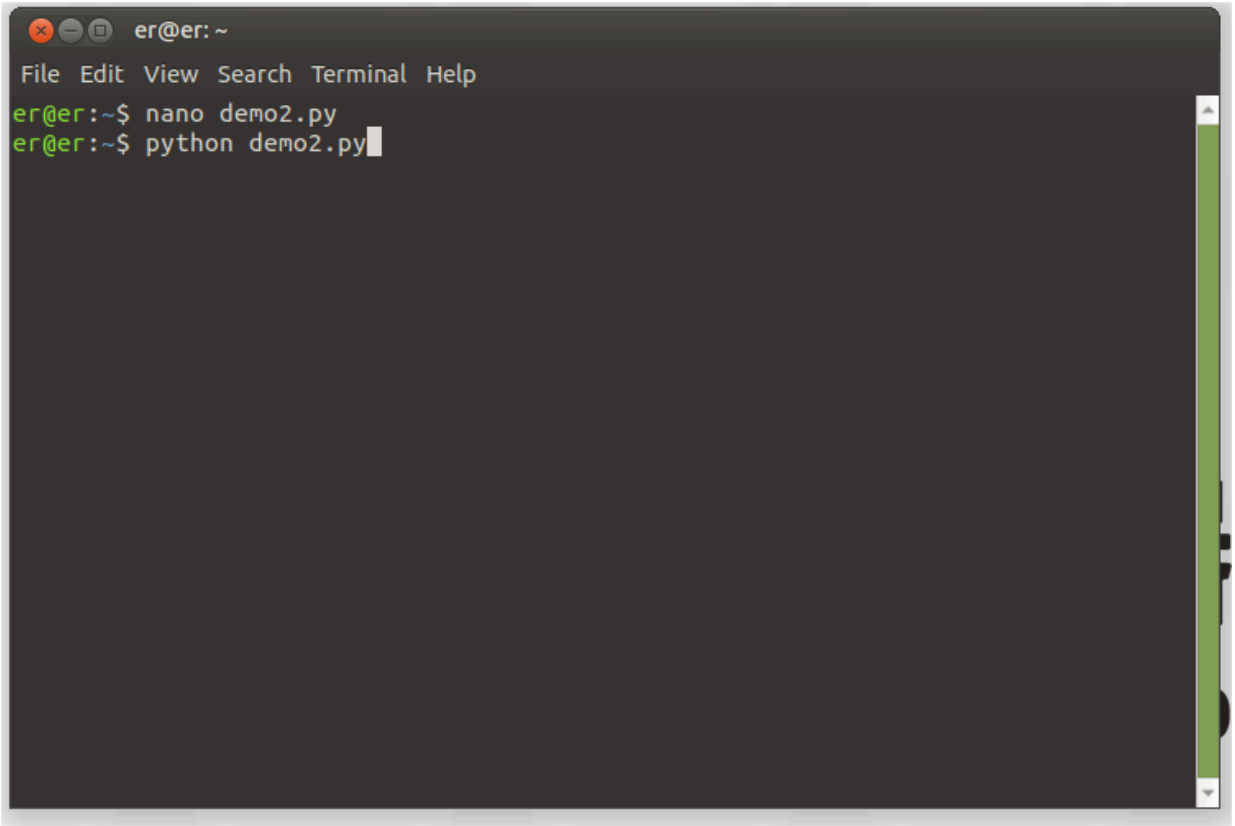


After writing the Python program, press `ctrl+s` to save the edited program, and then press `ctrl+x` to exit the editor.

In the open terminal, enter

```
python demo.py
```

to run the Python program you just wrote.



pymycobot is a Python package for serial communication with myCobot, supporting Python2, Python3.5 and later versions.

Before using pymycobot to control the robot arm, you need to build a Python environment. The following is a detailed description of Python download and installation.

Python download and installation for personal PC

This section will guide you to install Python on your personal PC. You can write the Python program on your personal PC and then copy it to the Ubuntu system of the robot arm via a USB flash drive.

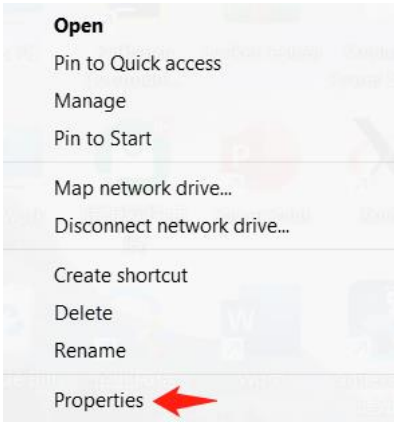
Applicable devices:

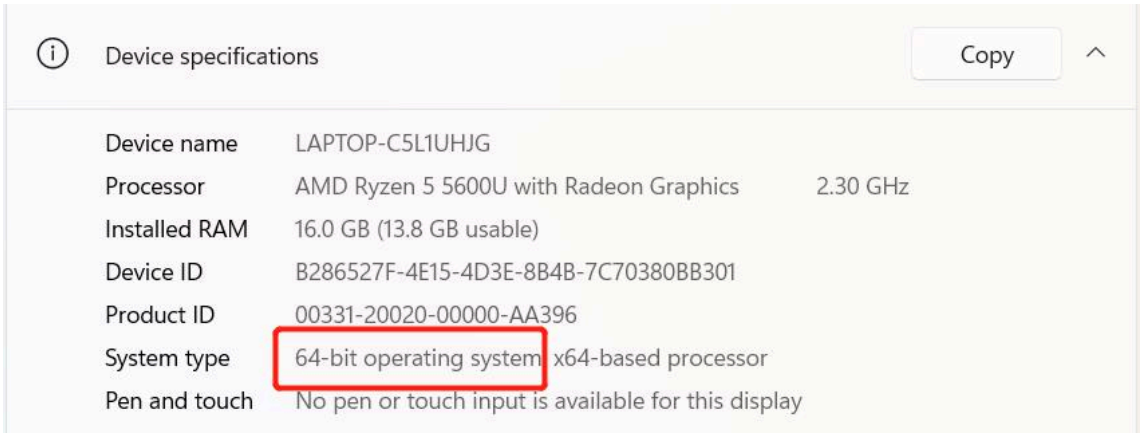
- myCobot 280:
- myCobot 280 M5
- **myCobot 280 PI**
- myCobot 280 Jetson Nano
- myCobot 280 for Arduino

Currently, there are two versions of Python, one is `2.x` version and the other is `3.x` version. These two versions are incompatible. As `3.x` version is becoming more and more popular, our tutorial will take the latest `3.10.7` version as an example.

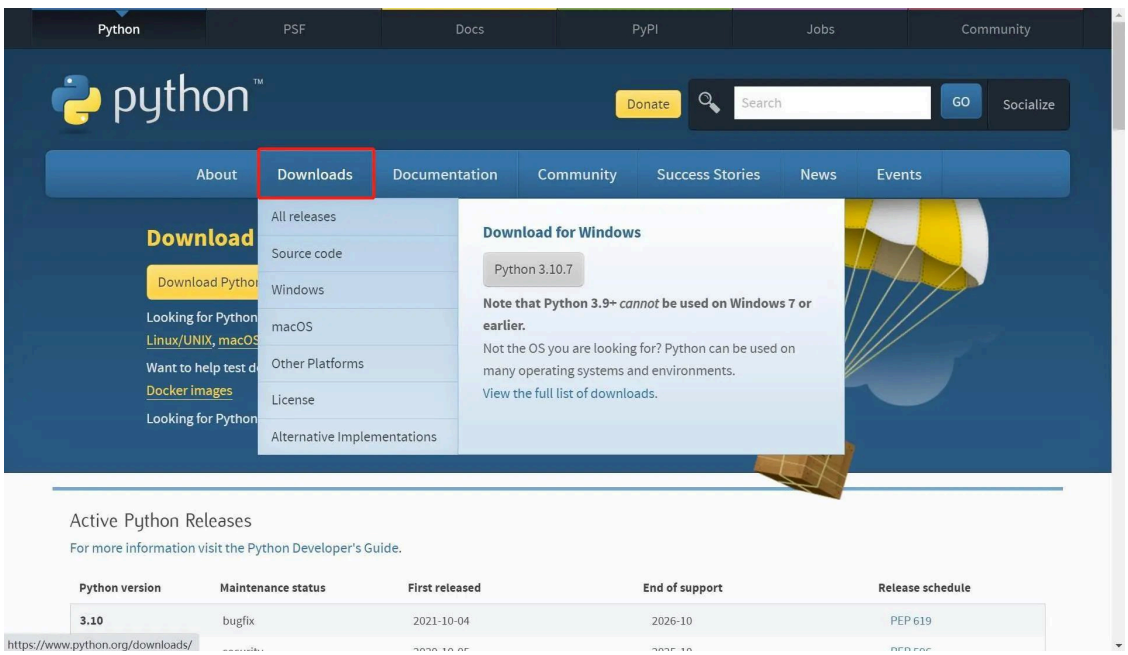
Install Python

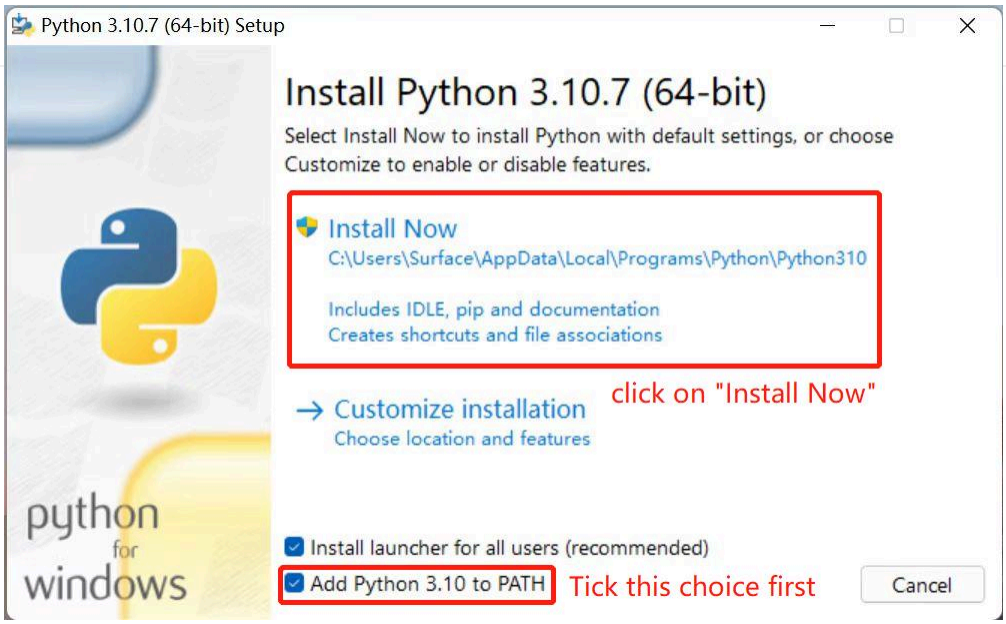
> **Note:** Before installing, please confirm whether your computer is 64-bit or 32-bit. Right-click `My Computer` and select `Properties`. As shown in the figure below, it is a 64-bit operating system, so select the 64-bit Python installation package.

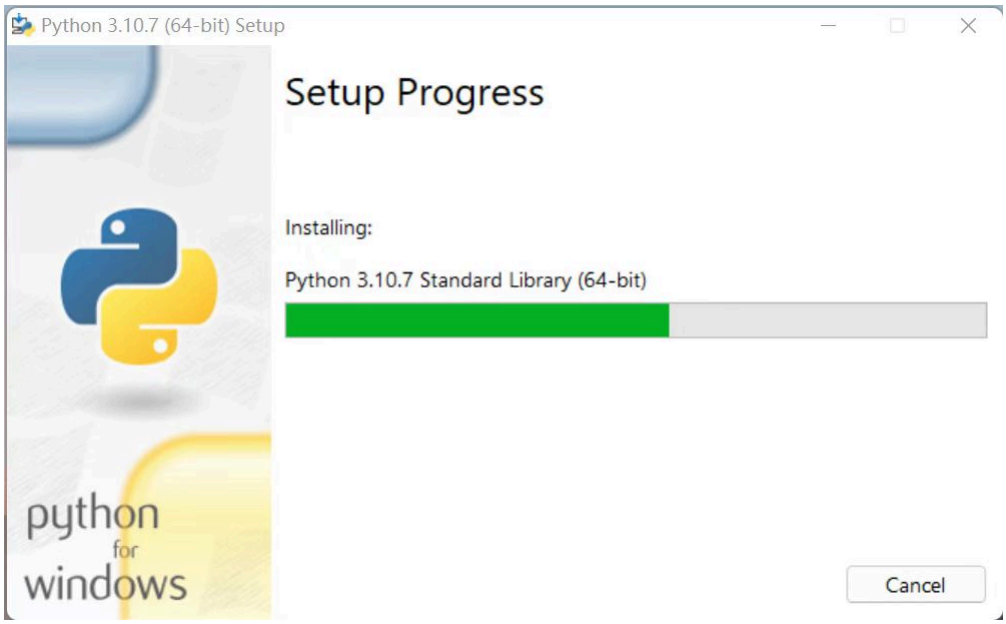




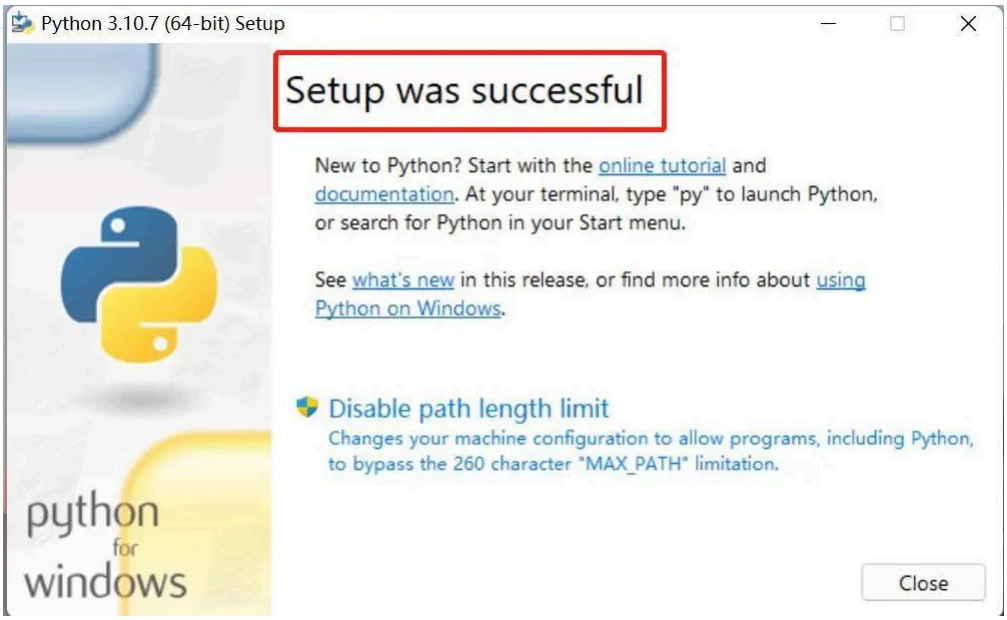
- **Python official download address: https://www.python.org/downloads/**
- **Click the `Downloads` option to start downloading Python, click `Add Python 3.10 to PATH`, click `Install Now` to start installing Python**




Python 3.10.7 (64-bit) Setup
Install Python 3.10.7 (64-bit)
Select Install Now to install Python with default settings, or choose
Customize to enable or disable features.
Install Now
C:\Users\Surface\AppData\Local\Programs\Python\Python310
Includes IDLE, pip and documentation
Creates shortcuts and file associations
click on "Install Now"
Customize installation
Choose location and features
python
for
windows
Install launcher for all users (recommended)
Add Python 3.10 to PATH
Tick this choice first
Cancel


Python 3.10.7 (64-bit) Setup
Setup Progress
Installing:
Python 3.10.7 Standard Library (64-bit)
python
for
windows
Cancel

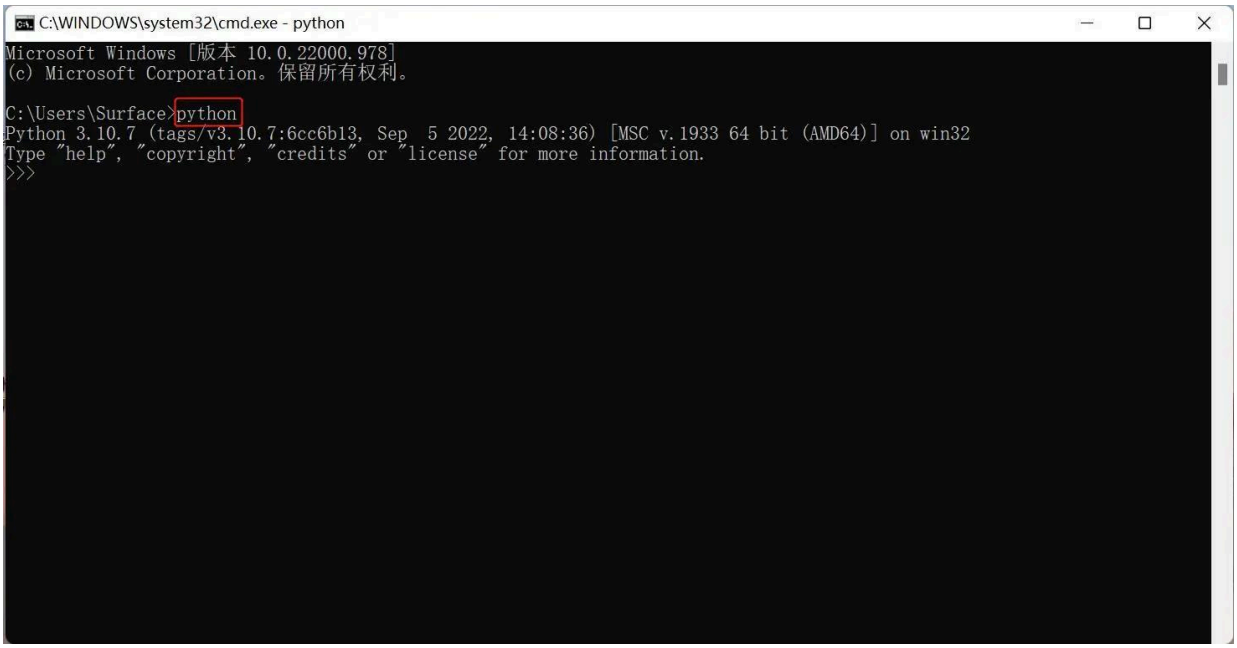
- **The prompt "Setup was successful" appears, indicating that the installation is complete**



Run Python

After successful installation, open the command prompt window (Win+R, enter cmd and press Enter), and type `python`. Two situations will occur.

Situation 1:



The prompt in the picture indicates that Python has been successfully installed.

The prompt `>>>` indicates that we are already in the Python interactive environment. We can enter any Python code and get the execution result immediately after pressing Enter.

Case 2:

If the input is wrong (for example, enter pythonn), an error message will appear:

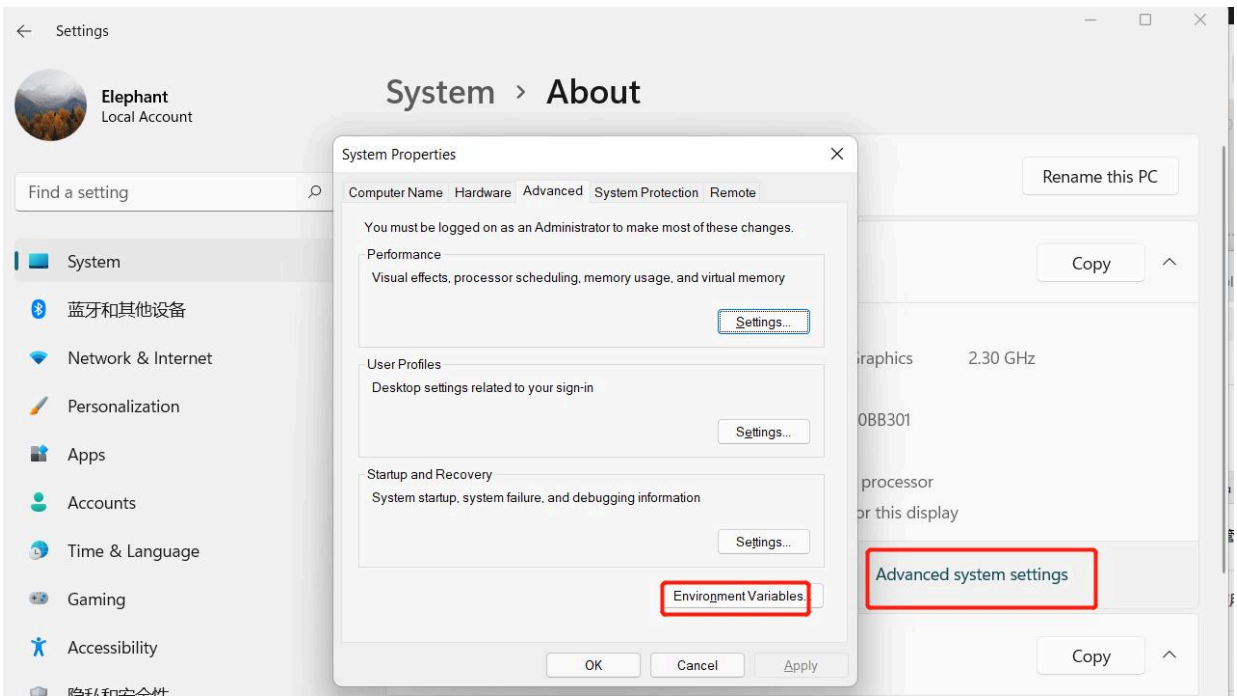
> **Note:** The error message is generally caused by not configuring the environment variables. You can refer to **1.3 Configure environment variables** to modify the environment variables.

Configure environment variables

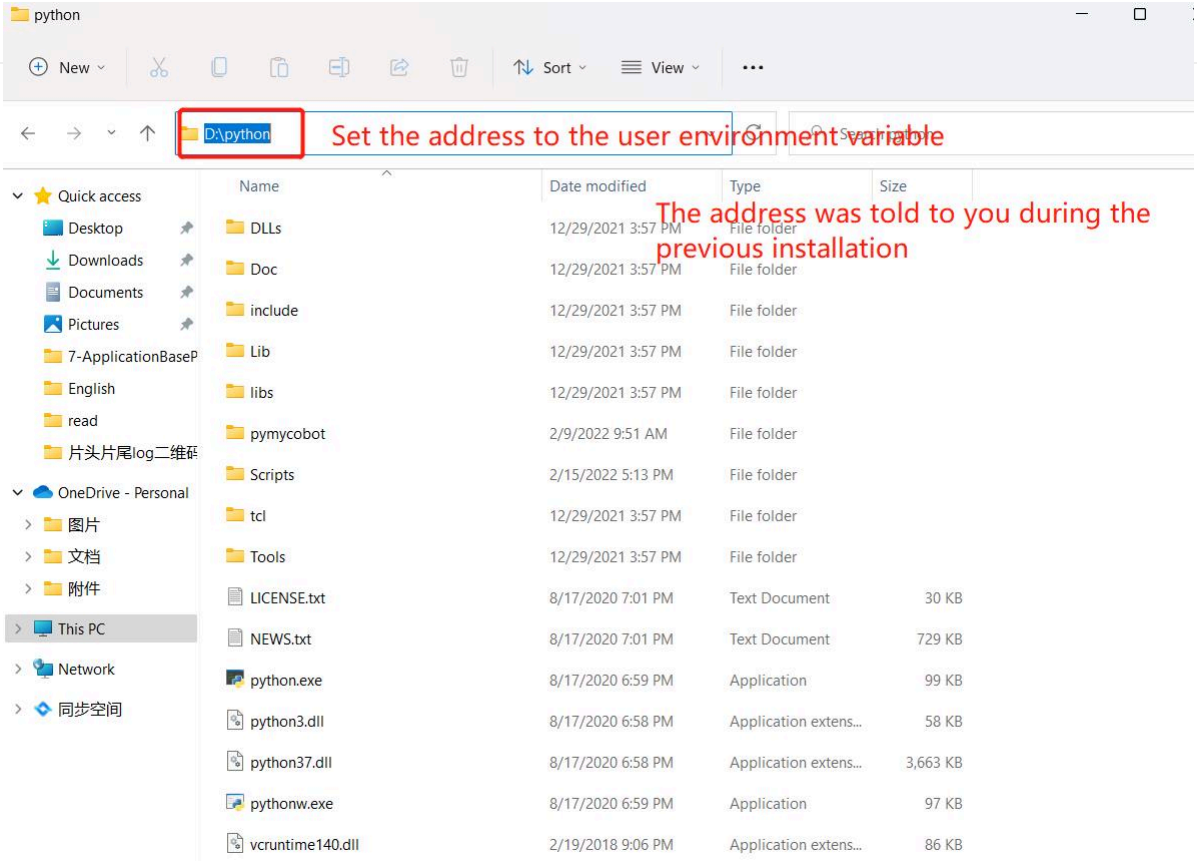
Since Windows will search for python.exe according to the path set by a Path environment variable, if it is not found, an error will be reported. Therefore, if you miss checking `Add Python 3.10 to PATH` during installation, you need to manually add the path where python.exe is located to Path, or reinstall Python and remember to check the `Add Python 3.10 to PATH` option.

The following are the steps to manually add the path where python.exe is located.

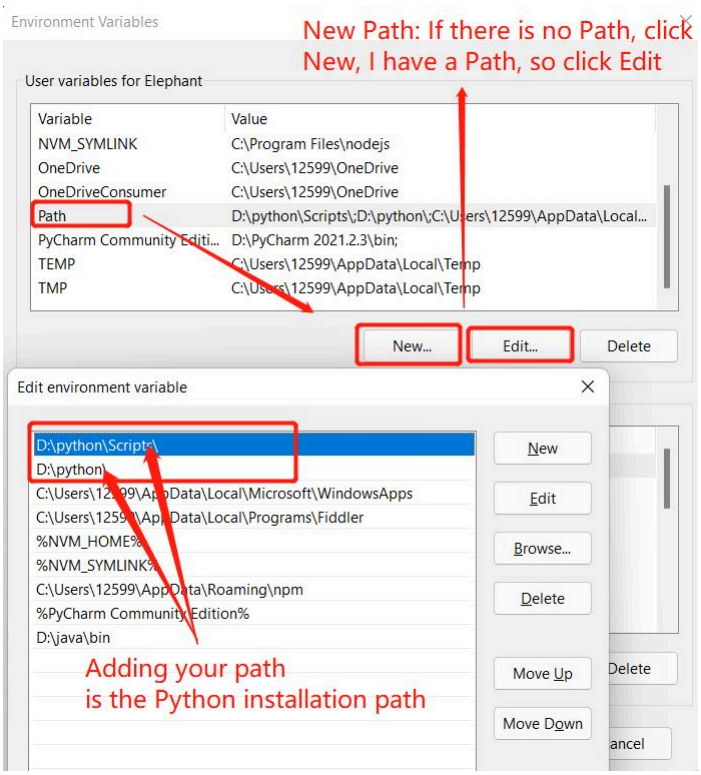
- Right-click My Computer –> Select Properties –> Select Advanced System Settings –> Select Environment Variables in the lower right corner:



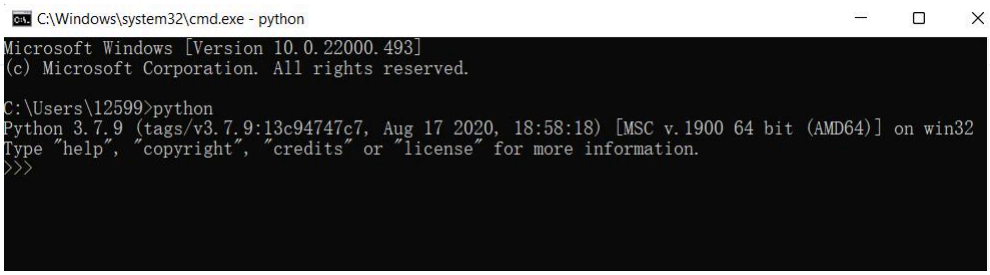
- Environment variables mainly include user variables and system variables. The environment variables that need to be set are in these two variables. As shown in the figure below:



- User variables are used to download programs that can be used in cmd commands. Write the absolute path of the program to the user variable and you can use it, as shown in the figure below:



- After completing the above steps, open the command prompt window (Win+R, then enter cmd, press Enter), type Python, and the prompt in the figure below indicates success:



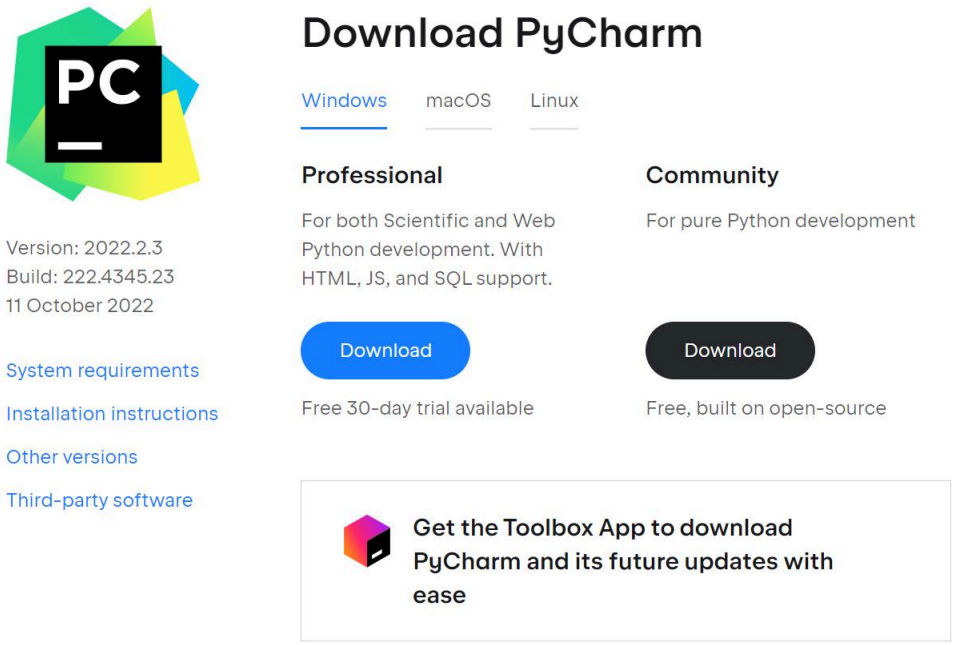
PyCharm installation and use

PyCharm is a powerful Python editor with cross-platform capabilities. First, let's introduce the installation steps of PyCharm in Windows system.

Download address: https://www.jetbrains.com/pycharm/download/#section=windows

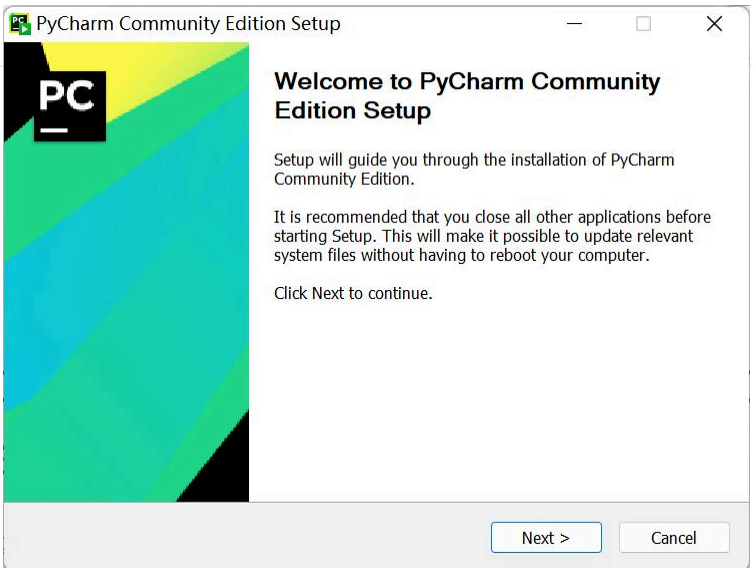
Download and install

- After entering the website, we will see the following interface:

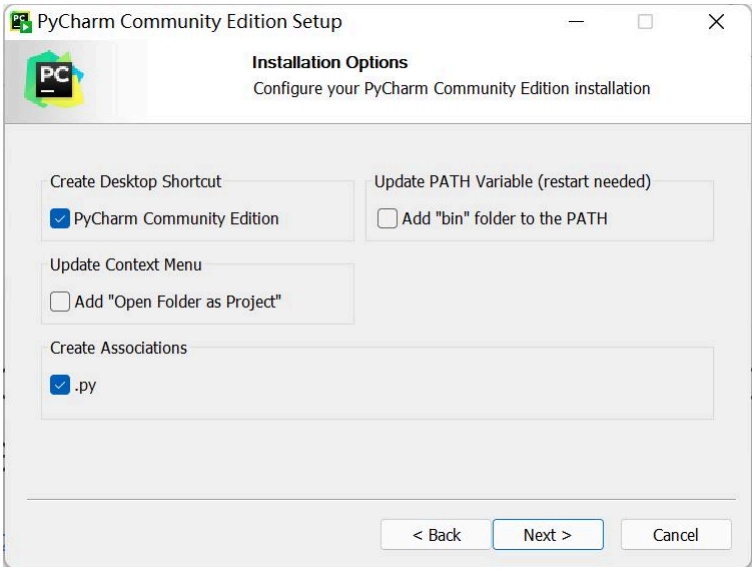


Download the file according to the interface introduction. Professional means professional version, and Community means community version. It is recommended to install the community version because it is free to use.

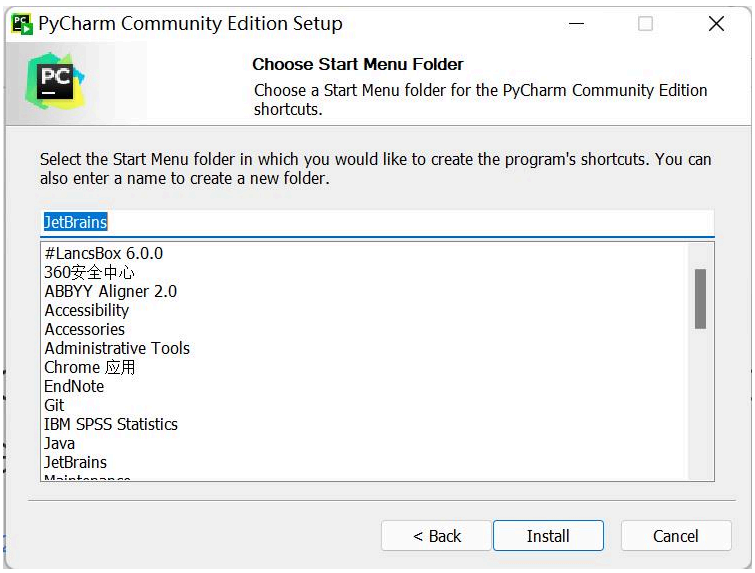
- After downloading, start installing and click `Next`:



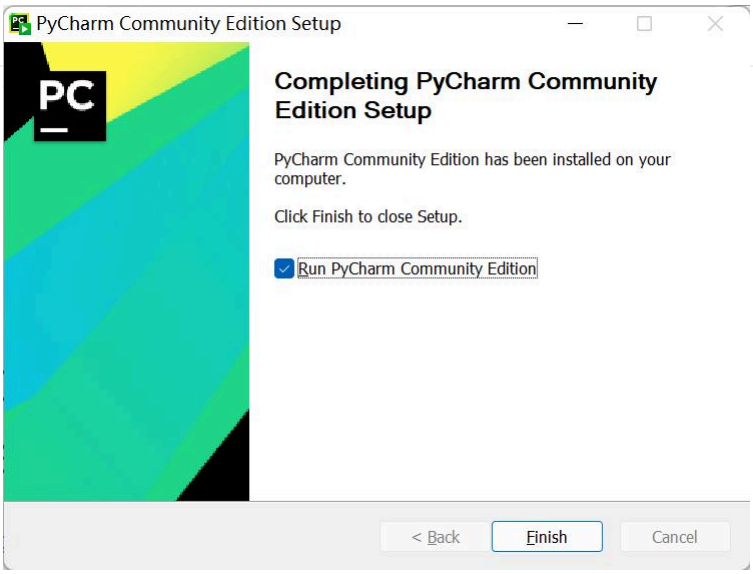
- Select the corresponding options according to your personal preferences, and then click `Next` :



- The following interface appears and continue to click `Next` :



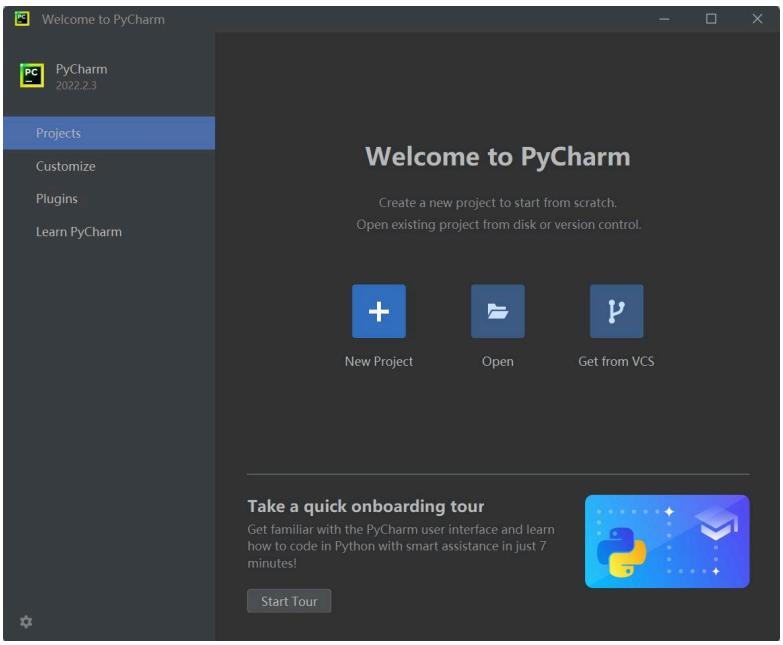
- Click `Finish` to complete the installation:



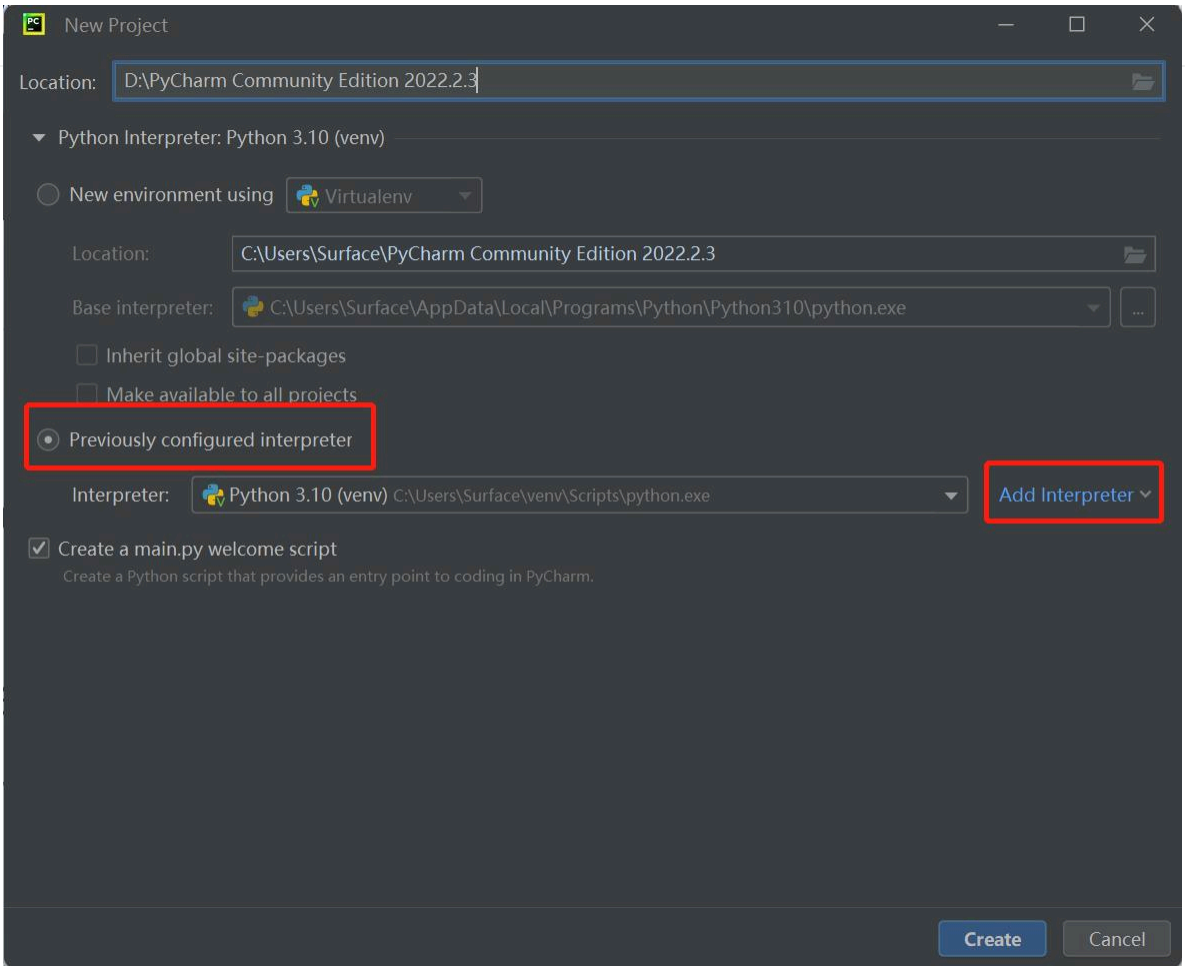
Create a project

After PyCharm is installed, enter the software and create the first program.

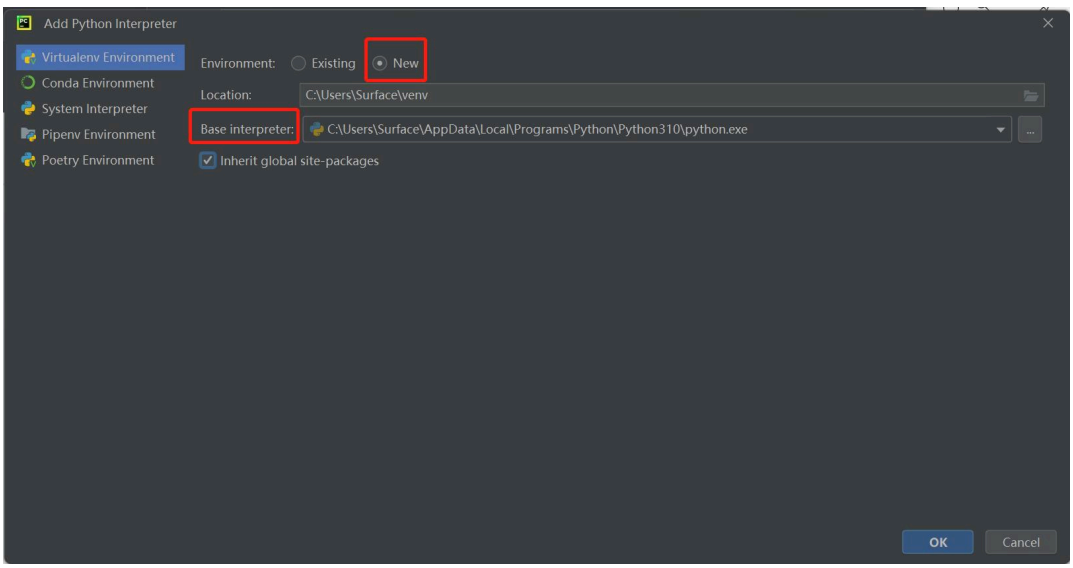
- Click the PyCharm icon on the desktop to enter PyCharm, as shown in the figure below, and click `New Project` :



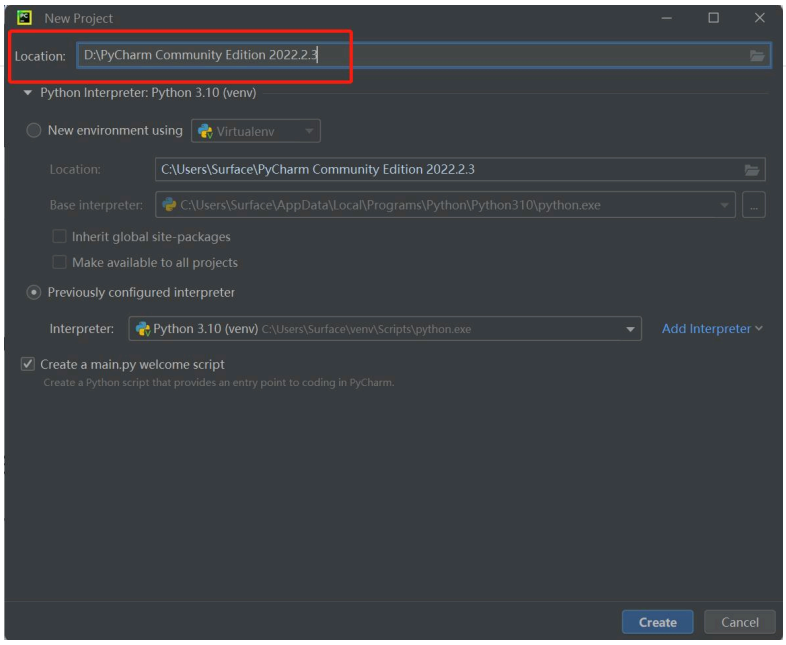
- After clicking, find `Interpreter` , start setting the interpreter, and click `Add Interpreter` :



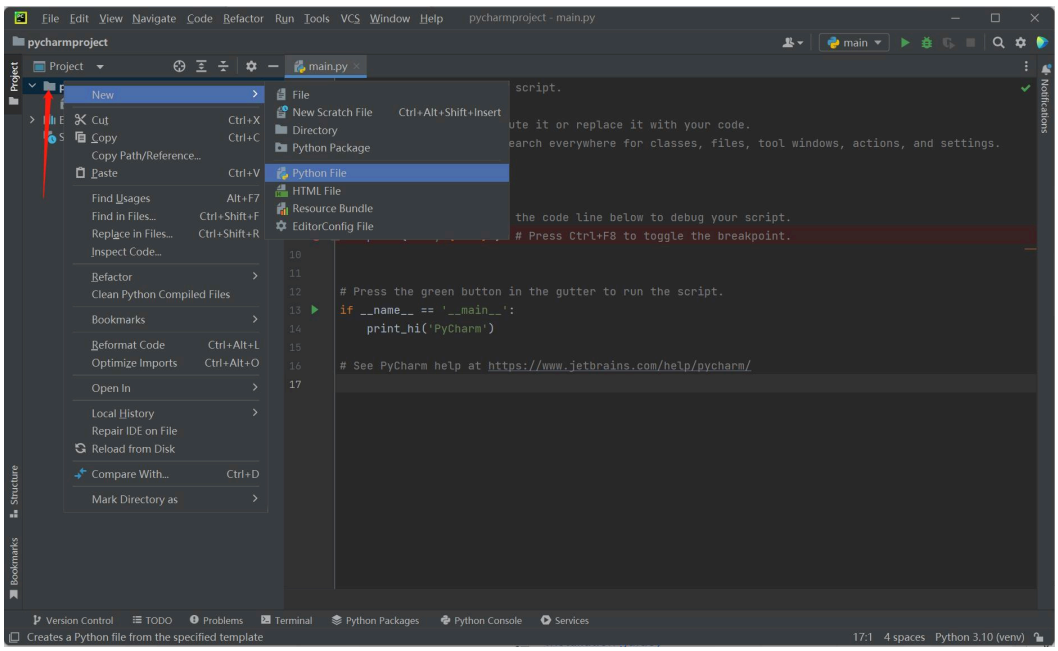
- Click `New`, find the python.exe storage location, and check the `Inherit global site-package` option:



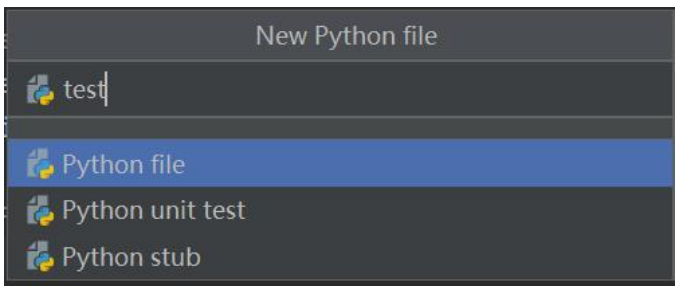
- Set `Location`. Location is where the PyCharm project is stored. You can choose it according to your needs.



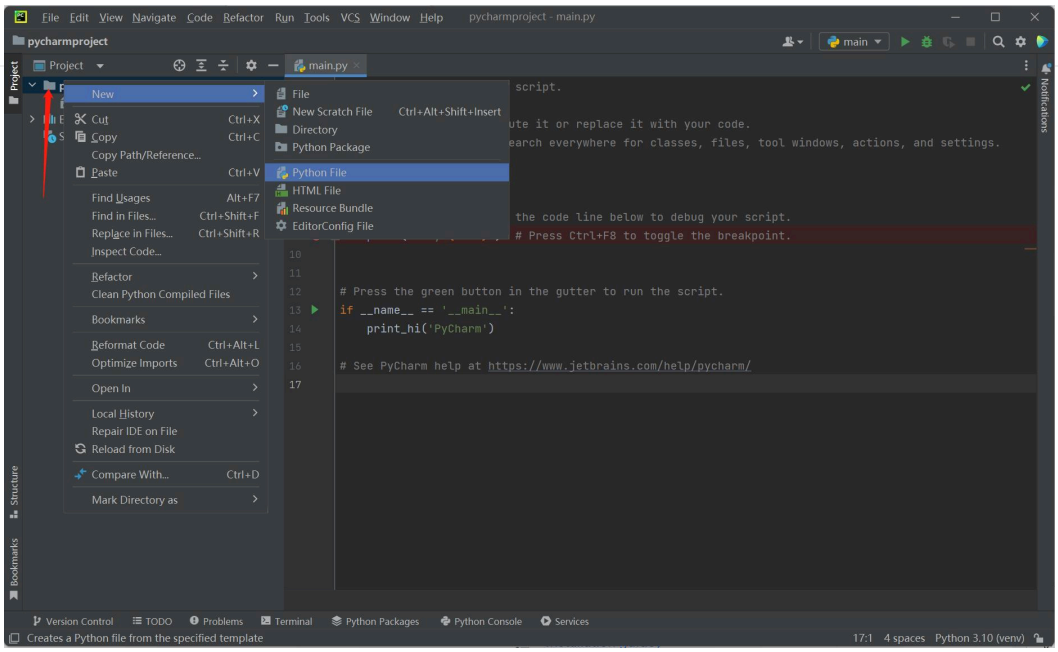
- Create a new PyCharm file. Right-click the document icon pointed by the arrow, click `New` , click `Python File` , and the new file is created successfully.



- Name Python File:



- After the file is successfully created, you will enter the following interface and you can write your own program



Before use

- Firmware burning. Firmware refers to the device "driver" stored inside the device. Only through firmware can the operating system implement the operation of a specific machine according to the standard device driver. Different versions of the robot arm need to burn different firmware (refer to the **MyStudio**chapter).
- **M5 version** The Basic at the bottom needs to burn minirobot. After the burning is completed, select the **Transponder** function (this function is used to receive and forward the instructions sent by the Basic at the bottom to perform the target action), click `Press A`, and the **Atom: OK** prompt message appears, which means success. In addition, the latest version of atomMain is burned in the Atom at the end of the M5 version. It is burned by default at the factory, and there is no need to burn it yourself.
- **Pi \ jetsonnano version** The latest version of atomMain is burned in the Atom at the end. It is burned by default at the factory, and there is no need to burn it yourself.
- pymycobot installation. Open a console terminal (shortcut Win+R, enter cmd to enter the terminal), and enter the following command:

```
pip install pymycobot --upgrade --user
```

- Source code installation. Open a console terminal (shortcut Win+R, enter cmd to enter the terminal), enter the following command to install:

```
git clone https://github.com/elephantrobotics/pymycobot.git <your-path>
#Where <your-path> fills in your installation address, if not filled in, the current path is used by default


cd <your-path>/pymycobot
#Enter the pymycobot folder of the download package


#Run one of the following commands according to your python version
# Install
python2 setup.py install
# or
python3 setup.py install
```

Simple use of Python

After the above preparations are completed, start to control the robot arm through Python code. Here, the MyCobot 280 PI version is used as an example for demonstration.

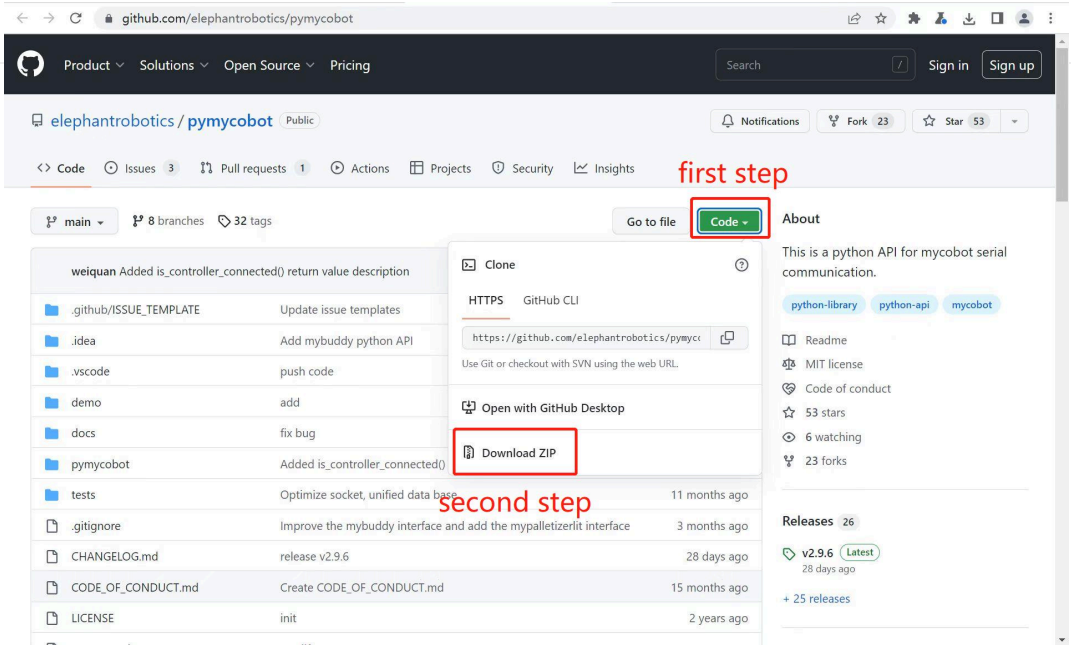
First, open the PyCharm you installed, create a new Python file, enter the following code, and import our library:

```
from pymycobot.pymycobot280 import MyCobot280
```

Note:

1. If you enter `from pymycobot.pymycobot280 import MyCobot280` , there is no red wavy line under the font, which proves that it has been successfully installed and can be used. If a red wavy line appears, you can refer to **How to install the API library** , **How to call the API library**.
2. If you do not want to install the API library through the above command, you can download the project to your local computer through the following github.

First, go to the project address: **https://github.com/elephantrobotics/pymycobot**. Then click the Code button on the right side of the webpage, and then click Download ZIP to download it locally. Put the pymycobot folder in the compressed package pymycobot file project into your python dependency library directory, and you can directly import and use it.



Simple Demonstration

Create a new Python file in PyCharm and enter the following code to execute the LED flashing.

> **Note:** The corresponding baud rates of various devices are different. Please refer to the information to understand their baud rates when using them. The serial port number can be viewed through **Calculator Device Manager** or the serial port assistant.

The following are the corresponding codes.

```
from pymycobot.mycobot280 import MyCobot280
import time
#The above needs to be written at the beginning of the code, which means importing the project package

# MyCobot280 class initialization requires two parameters: serial port and baud rate

# Initialize a MyCobot280 object
# The following is the object code for the Windows version
mc = MyCobot280("/dev/ttyAMA0", 1000000)

i = 7
# Loop 7 times
  while i > 0:
  mc.set_color(0,0,255) #Blue light on
  time.sleep(2) #Wait 2 seconds
  mc.set_color(255,0,0) #Red light on
  time.sleep(2) #Wait 2 seconds
  mc.set_color(0,255,0) #Green light on
  time.sleep(2) #Wait 2 seconds
  i -= 1
```

MyCobot 280

[toc]

Python API usage instaructions

API (Application Programming Interface), also known as Application Programming Interface functions, are predefined functions. When using the following function interfaces, please import our API library at the beginning by entering the following code, otherwise it will not run successfully:

```
# Example
from pymycobot import MyCobot280

mc = MyCobot280('/dev/ttyAMA0', 1000000)

# Gets the current angle of all joints
angles = mc.get_angles()
print(angles)

# Set 1 joint to move to 40 and speed to 20
mc.send_angle(1, 40, 20)
```

> **Note:** Some function interfaces have return values, but if you enter the code directly, the result returned is no return value. You need to use the print function to print out the result. For example, if you want to get the current angle value of the robot arm, you can use get_angles(), but directly entering this function will not give you any result. The correct way to write it is: print(get_angles()) to print out the speed value. If the API description below indicates that there is no return value, you do not need to use the print function. Otherwise, you need to use the print function to print the result.

1. System Status

1.1 `get_system_version()`

- **function：** get system version
- **Return value：** system version

1.2 `get_basic_version()`

- **function：** Get basic firmware version for M5 version
- **Return value：** `float` firmware version

1.3 `get_error_information()`

- **function：** Obtaining robot error information
- **Return value：**
  - 0: No error message.
  - 1 ~ 6: The corresponding joint exceeds the limit position.
  - 16 ~ 19: Collision protection.

- 32: Kinematics inverse solution has no solution.
- 33 ~ 34: Linear motion has no adjacent solution.

1.4 `clear_error_information()`

- **function:** Clear robot error message

2. Overall Status

2.1 `power_on()`

- **function:** atom open communication (default open)
- **Return value:**
  - `1` - Power on completed.

2.2 `power_off()`

- **function:** Power off of the robotic arm
- **Return value:**
  - `1` - Power on completed.

2.3 `is_power_on()`

- **function:** judge whether robot arms is powered on or not
- **Return value:**
  - `1` : power on
  - `0` : power off
  - `-1` : error

2.4 `release_all_servos()`

- **function:** release all robot arms
  - Attentions：After the joint is disabled, it needs to be enabled to control within 1 second
- **Parameters：** `data` （optional）：The way to relax the joints. The default is damping mode, and if the 'data' parameter is provided, it can be specified as non damping mode (1- Undamping).
- **Return value:**
  - `1` - release completed.

2.5 `focus_servo(servo_id)`

- **function:** Power on designated servo
- **Parameters:**
  - `servo_id:` int, 1-6
- **Return value:**
  - `1` : complete

2.6 `is_controller_connected()`

- **function:** Wether connected with Atom
- **Return value:**
  - `1` : succeed
  - `0` : failed
  - `-1` : error data

2.7 `read_next_error()`

- **function:** Robot Error Detection
- **Return value:** list len 6
  - `0` : No abnormality
  - `1` : Communication disconnected
  - `2` : Unstable communication
  - `3` : Servo abnormality

2.8 `get_fresh_mode()`

- **function:** Query sports mode
- **Return value:**
  - `0` : Interpolation mode
  - `1` : Refresh mode

2.9 `set_fresh_mode()`

- **function:** Set command refresh mode
- **Parameters:**
  - `1` : Always execute the latest command first.
  - `0` : Execute instructions sequentially in the form of a queue.
- **Return value:**
  - `1` : complete

2.10 `set_free_mode()`

- **function:** set to free mode
- **Parameters:**
  - `1` : open free mode
  - `0` : close free mode
- **Return value:**
  - `1` : complete

2.11 `is_free_mode()`

- **function:** Check if it is free mode

- **Return value:**
  - `1` : free mode
  - `0` : on-free mode

2.12 `focus_all servos()`

- **Function:** All servos are powered on
- **Return value:**
  - `1` : complete

2.13 `set_vision_mode()`

- **Function:** Set the vision tracking mode, limit the attitude flip of send_coords in refresh mode. (Applicable only to vision tracking function)
- **Parameter:**
  - `1` : open
  - `0` : close
- **Return value:**
  - `1` : complete

3.MDI Mode and Operation

3.1 `get_angles()`

- **function:** get the degree of all joints
- **Return value**: `list` a float list of all degree

3.2 `send_angle(id, degree, speed)`

- **function:** send one degree of joint to robot arm
- **Parameters:**
  - `id` : Joint id, range int 1-6
  - `degree` : degree value(`float`)

> **Note:** ⚠ This joint limit information function is only available on Atom firmware ≥ 7.3 and pymycobot library ≥ 4.0.2.

Joint Id	Range
1	-168 ~ 168
2	-140 ~ 140
3	-150 ~ 150
4	-150 ~ 150
5	-155 ~ 160
6	-180 ~ 180

- `speed`： the speed and range of the robotic arm's movement 1~100
- **Return value:**
  - `1` : complete

3.3 `send_angles(angles, speed)`

- **function：** Send all angles to all joints of the robotic arm
- **Parameters:**
  - `angles` : a list of degree value(`List[float]`), length 6
  - `speed` : (`int`) 1 ~ 100
- **Return value:**
  - `1` : complete

3.4 `get_coords()`

- **function:** Obtain robot arm coordinates from a base based coordinate system
- **Return value:** a float list of coord:[x, y, z, rx, ry, rz]

3.5 `send_coord(id, coord, speed)`

- **function:** send one coord to robot arm
- **Parameters:**
  - `id` :send one coord to robot arm, 1-6 corresponds to [x, y, z, rx, ry, rz]
  - `coord` : coord value(`float`)

Coord ID	Range
x	-281.45 ~ 281.45
y	-281.45 ~ 281.45
z	-70 ~ 412.67
rx	-180 ~ 180
ry	-180 ~ 180
rz	-180 ~ 180

  - `speed` : (`int`) 1-100
- **Return value:**
  - `1` : complete

3.6 `send_coords(coords, speed, mode)`

- **function:**: Send overall coordinates and posture to move the head of the robotic arm from its original point to your specified point
- **Parameters:**
  - coords: ： a list of coords value `[x,y,z,rx,ry,rz]` ,length6
  - speed `(int)` : 1 ~ 100
  - mode: `(int)` 0 - angluar, 1 - linear
- **Return value:**

- `1` : complete

3.7 `pause()`

- **function:** Control the instruction to pause the core and stop all movement instructions
- **Return value**:
  - `1` - stopped
  - `0` - not stop
  - `-1` - error

3.8 `sync_send_angles(angles, speed, timeout=15)`

- **function：** Send the angle in synchronous state and return when the target point is reached
- **Parameters:**
  - `angles` : a list of degree value(`List[float]`), length 6
  - `speed` : (`int`) 1 ~ 100
  - `timeout` : default 15 seconds
- **Return value:**
  - `1` : complete

3.9 `sync_send_coords(coords, speed, mode=0, timeout=15)`

- **function：** Send the coord in synchronous state and return when the target point is reached
- **Parameters:**
  - `coords` : a list of coord value(`List[float]`), length 6
  - `speed` : (`int`) 1 ~ 100
  - `mode` : (`int`) 0 - angular（default）, 1 - linear
  - `timeout` : default 15 seconds
- **Return value:**
  - `1` : complete

3.10 `get_angles_coords()`

- **function：** Get joint angles and coordinates
- **Return value:** A list with a length of 12. The first six digits are angle information, and the last six digits are coordinate information.

3.11 `is_paused()`

- **function:** Check if the program has paused the move command
- **Return value:**
  - `1` - paused
  - `0` - not paused
  - `-1` - error

3.12 `resume()`

- **function:** resume the robot movement and complete the previous command
- **Return value:**
  - `1` - complete

3.13 `stop()`

- **function:** stop all movements of robot
- **Return value**:
  - `1` - stopped
  - `0` - not stop
  - `-1` - error

3.14 `is_in_position(data, flag)`

- **function** : judge whether in the position.
- **Parameters:**
  - data: Provide a set of data that can be angles or coordinate values. If the input angle length range is 6, and if the input coordinate value length range is 6
  - flag data type (value range 0 or 1)
    - `0` : angle
    - `1` : coord
- **Return value**:
  - `1` - true
  - `0` - false
  - `-1` - error

3.15 `is_moving()`

- **function:** judge whether the robot is moving
- **Return value:**
  - `1` moving
  - `0` not moving
  - `-1` error

3.16 `angles_to_coords(angles)`

- **Function** : Convert angles to coordinates.
- **Parameters:**
  - `angles` : `list` List of floating points for all angles.
- **Return value**: `list` List of floating points for all coordinates.

3.17 `solve_inv_kinematics(target_coords, current_angles)`

- **Function** : Convert coordinates to angles.
- **Parameters:**
  - `target_coords` : `list` List of floating points for all coordinates.
  - `current_angles` : `list` List of floating points for all angles, current angles of the robot
- **Return value**: `list` List of floating points for all angles.

4. JOG Mode and Operation

4.1 `jog_angle(joint_id, direction, speed)`

- **function:** jog control angle
- **Parameters**:

  - `joint_id` : Represents the joints of the robotic arm, represented by joint IDs ranging from 1 to 6
  - `direction(int)` : To control the direction of movement of the robotic arm, input `0` as negative value movement and input `1` as positive value movement
  - `speed` : 1 ~ 100
- **Return value:**
  - `1` : complete

4.2 `jog_coord(coord_id, direction, speed)`

- **function:** jog control coord.
- **Parameters:**
  - `coord_id` : (`int`) Coordinate range of the robotic arm: 1~6
  - `direction` : (`int`) To control the direction of machine arm movement, `0` - negative value movement, `1` - positive value movement
  - `speed` : 1 ~ 100
- **Return value:**
  - `1` : complete

4.3 `jog_rpy(end_direction, direction, speed)`

- **function:** Rotate the end around a fixed axis in the base coordinate system
- **Parameters:**
  - `end_direction` : (`int`) Roll, Pitch, Yaw (1-3)
  - `direction` : (`int`) To control the direction of machine arm movement, `1` - forward rotation, `0` - reverse rotation
  - `speed` : (`int`) 1 ~ 100
- **Return value:**
  - `1` : complete

4.4 `jog_increment_angle(joint_id, increment, speed)`

- **Function**: Angle stepping, single joint angle increment control
- **Parameter**:
  - `joint_id` : 1-6
  - `increment` : Incremental movement based on the current position angle
  - `speed` : 1~100
- **Return value:**
  - `1` : Completed

4.5 `jog_increment_coord(id, increment, speed)`

- **Function**: Coordinate stepping, single coordinate increment control
- **Parameter**:
  - `id` : Coordinate axis 1-6
  - `increment` : Incremental movement based on the current position coordinate
  - `speed` : 1~100
- **Return value:**
  - `1` : Completed

4.6 `set_encoder(joint_id, encoder, speed)`

- **function**: Set a single joint rotation to the specified potential value
- **Parameters**
  - `joint_id` : (`int`) 1-6
  - `encoder` : 0 ~ 4096
  - `speed` : 1 ~ 100
- **Return value:**
  - `1` : complete

4.7 `get_encoder(joint_id)`

- **function**: Set a single joint rotation to the specified potential value
- **Parameters**
  - `joint_id` : (`int`) 1-6
- **Return value:** (`int`) Joint potential value

4.8 `set_encoders(encoders, speed)`

- **function**: Set the six joints of the manipulator to execute synchronously to the specified position.
- **Parameters**
  - `joint_id` : (`int`) 1-6
  - `encoder` : 0 ~ 4096
  - `speed` : 1 ~ 100
- **Return value:**
  - `1` : complete

4.9 `get_encoders()`

- **function**: Get the six joints of the manipulator.
- **Return value:** (`list`) the list of encoders

5. Running status and Settings

5.1 `get_joint_min_angle(joint_id)`

- **function:** Gets the minimum movement angle of the specified joint
- **Parameters:**
  - `joint_id` : Enter joint ID (range 1-6)
- **Return value**： `float` Angle value

5.2 `get_joint_max_angle(joint_id)`

- **function:** Gets the maximum movement angle of the specified joint
- **Parameters:**
  - `joint_id` : Enter joint ID (range 1-6)
- **Return value:** `float` Angle value

5.3 `set_joint_min(id, angle)`

- **function:** Set minimum joint angle limit
- **Parameters:**
  - `id` : Enter joint ID (range 1-6)
  - `angle` : Refer to the limit information of the corresponding joint in the send_angle() interface, which must not be less than the minimum value
- **Return value:**
  - `1` : complete

5.4 `set_joint_max(id, angle)`

- **function:** Set maximum joint angle limit
- **Parameters:**
  - `id` : Enter joint ID (range 1-6)
  - `angle` : Refer to the limit information of the corresponding joint in the send_angle() interface, which must not be greater than the maximum value
- **Return value:**
  - `1` : complete

6. Joint motor control

6.1 `is_servo_enable(servo_id)`

- **function:** Detecting joint connection status
- **Parameters:** `servo id` 1-6
- **Return value:**
  - `1` : Connection successful
  - `0` : not connected
  - `-1` : error

6.2 `is_all_servo_enable()`

- **function:** Detect the status of all joint connections
- **Return value:**
  - `1` : Connection successful
  - `0` : not connected
  - `-1` : error

6.3 `set_servo_calibration(servo_id)`

- **function:** The current position of the calibration joint actuator is the angle zero point
- **Parameters**:
  - `servo_id` : 1 - 6
- **Return value:**
  - `1` : complete

6.4 `release_servo(servo_id)`

- **function:** Set the specified joint torque output to turn off
- **Parameters**:

  - `servo_id` : 1 ~ 6
- **Return value:**
  - `1` : release successful
  - `0` : release failed
  - `-1` : error

6.5 `focus_servo(servo_id)`

- **function**: Set the specified joint torque output to turn on
- **Parameters**: `servo_id` : 1 ~ 6
- **Return value:**
  - `1` : focus successful
  - `0` : focus failed
  - `-1` : error

6.6 `set_servo_data(servo_id, data_id, value, mode=None)`

- **function:** Set the data parameters of the specified address of the steering gear
- **Parameters**：
  - `servo_id` : (`int`) joint id 1 - 6
  - `data_id` : (`int`) Data address
  - `value` : (`int`) 0 - 4096
  - `mode` : 0 - indicates that value is one byte(default), 1 - 1 represents a value of two bytes.
- **Return value:**
  - `1` : complete

6.7 `get_servo_data(servo_id, data_id, mode=None)`

- **function:** Read the data parameter of the specified address of the steering gear.
- **Parameters**：
  - `servo_id` : (`int`) joint id 1 - 6
  - `data_id` : (`int`) Data address
  - `mode` : 0 - indicates that value is one byte(default), 1 - 1 represents a value of two bytes.
- **Return value:** 0 ~ 4096

6.8 `joint_brake(joint_id)`

- **function:** Make it stop when the joint is in motion, and the buffer distance is positively related to the existing speed
- **Parameters**：
  - `joint_id` : (`int`) joint id 1 - 6
- **Return value:**
  - `1` : complete

7. 9g Servo

7.1 `move_round()`

- **function**： Drive the 9g steering gear clockwise for one revolution
- **Return value**：

- `1` : complete

7.2 `set_four_pieces_zero()`

- **function**：Set the zero position of the four-piece motor
- **Return value**：
  - `1` : success
  - `0` : failed

8. Servo state value

8.1 `get_servo_speeds()`

- **function**：Get the movement speed of all joints
- **Return value**： A list unit step/s

8.2 `get_servo_voltages()`

- **function**：Get joint voltages
- **Return value**： A list volts < 24 V

8.3 `get_servo_status()`

- **function**：Get the movement status of all joints
- **Return value**： A list,[voltage, sensor, temperature, current, angle, overload], a value of `0` means no error, a value of `1` indicates an error

8.4 `get_servo_temps()`

- **function**：Get joint temperature
- **Return value**： A list unit ℃

9. Robotic arm end IO control

9.1 `set_color(r, g, b)`

- **function**: Set the color of the end light of the robotic arm
- **Parameters**:
  - `r (int)` : 0 ~ 255
  - `g (int)` : 0 ~ 255
  - `b (int)` : 0 ~ 255
- **Return value**：
  - `1` : complete

9.2 `set_digital_output(pin_no, pin_signal)`

- **function:** set IO statue
- **Parameters**
  - `pin_no` (int): Pin number

- `pin_signal` (int): 0 / 1
- **Return value**:
  - `1` : complete

9.3 `get_digital_input(pin_no)`

- **function:** read IO statue
- **Parameters**: `pin_no` (int)
- **Return value**: signal

9.4 `set_pin_mode(pin_no, pin_mode)`

- **function:** Set the state mode of the specified pin in atom.
- **Parameters**
  - `pin_no` (int): Pin number
  - `pin_mode` (int): 0 - input, 1 - output, 2 - input_pullup
- **Return value**:
  - `1` : complete

10. Robotic arm end gripper control

10.1 `set_gripper_state(flag, speed, _type_1=None, is_torque=None)`

- **function**: Adaptive gripper enable
- **Parameters**:
  - `flag (int)` : 0 - open 1 - close, 254 - release
  - `speed (int)` : 0 ~ 100
  - `_type_1 (int)` :
    - `1` : Adaptive gripper (default state is 1)
    - `2` : A nimble hand with 5 fingers
    - `3` : Parallel gripper
    - `4` : Flexible gripper
  - `is_torque (int)` : Whether the gripper is force-controlled. This parameter can be omitted if no type parameter is specified. (**Note: This parameter is only supported when the end-end Atom firmware version is ≥ 6.5**)
    - `0` : Non-force-controlled gripper
    - `1` : Force-controlled gripper
- **Return value**:
  - `1` : complete

10.2 `set_gripper_value(gripper_value, speed, gripper_type=None, is_torque=None)`

- **function**: Set the gripper value
- **Parameters**:

- `gripper_value (int)` : 0 ~ 100
- `speed (int)` : 0 ~ 100
- `gripper_type (int)` :
  - `1` : Adaptive gripper (default state is 1)
  - `3` : Parallel gripper
  - `4` : Flexible gripper
- `is_torque (int)` : Whether the gripper is force-controlled. This parameter can be omitted if no type parameter is specified. (**Note: This parameter is only supported when the end-end Atom firmware version is ≥ 6.5**)
  - `0` : Non-force-controlled gripper
  - `1` : Force-controlled gripper

- **Return value**:
  - `1` : complete

10.3 `set_gripper_calibration()`

- **function**: Set the current position of the gripper to zero
- **Return value**:
  - `1` : complete

10.4 `is_gripper_moving()`

- **function**: Judge whether the gripper is moving or not
- **Return value**:
  - `0` : not moving
  - `1` : is moving
  - `-1` : error data

10.5 `get_gripper_value()`

- **function**: Get the value of gripper
- **Parameters**:
  - `gripper_type` : (int) default 1
    - 1: Adaptive gripper
    - 3: Parallel gripper
    - 4: Flexible gripper
- **Return value**: gripper value (int)

10.6 `set_pwm_output(channel, frequency, pin_val)`

- **function**: PWM control
- **Parameters**:
  - `channel` : (int): IO number.
  - `frequency` : (int): clock frequency
  - `pin_val` : (int) Duty cycle 0 ~ 256; 128 means 50%
- **Return value**:
  - `1` : complete

10.7 `set_HTS_gripper_torque(torque)`

- **function**: Set new adaptive gripper torque
- **Parameters**:
  - `torque` : (int): 150 ~ 980
- **Return value**:
  - `0` : Set failed
  - `1` : Set successful

10.8 `get_HTS_gripper_torque()`

- **function**: Get gripper torque
- **Return value**: (int) 150 ~ 980

10.9 `get_gripper_protect_current()`

- **function**: Get the gripper protection current
- **Return value**: (int) 1 ~ 500

10.10 `set_gripper_protect_current(current)`

- **function**: Set the gripper protection current
- **Parameters**:
  - `current` : (int): 1 ~ 500
- **Return value**:
  - `1` : complete

10.11 `init_gripper()`

- **function**: Initialize gripper
- **Return value**:
  - `1` : complete

10.12 `gripper_stop()`

> **Note:** Atom firmware version 7.3 or higher is required.

- **Function**: Stop gripper movement
- **Return value**:
  - `1` : Completed

10.13 `is_torque_gripper()`

- **Function**: Determines if the gripper is a force-controlled gripper type
- **Return Value**:
  - `40` : Force-controlled gripper
  - `9` : Non-force-controlled gripper

11. Set bottom IO input/output status

11.1 `set_basic_output(pin_no, pin_signal)`

- **function**：Set Base IO Output
- **Parameters**：
  - `pin_no` (`int`) Pin port number
  - `pin_signal` (`int`): 0 - low. 1 - high

11.2 `get_basic_input(pin_no)`

- **function:** Read base IO input
- **Parameters:**
  - `pin_no` (`int`) pin number
- **Return value:** 0 - low. 1 - high

12. TOF

12.1 `get_tof_distance()`

- **function:** Get the detected distance (Requires external distance detector)
- **Return value:** (int) The unit is mm.

13. Communication mode

13.1 `set_transponder_mode(mode)`

- **function:** Set basic communication mode
- **Parameters:**
  - `mode` : 0 - Turn off transparent transmission，1 - Open transparent transmission
- **Return value:**
  - `1` : complete

13.2 `get_transponder_mode()`

- **function:** Get basic communication mode
- **Parameters:**
- **Return value:**
  - `1` : Open transparent
  - `0` : Turn off transparent transmission

14. Cartesian space coordinate parameter setting

14.1 `set_tool_reference(coords)`

- **function:** Set tool coordinate system.
- **Parameters**：
  - `coords` : (`list`) [x, y, z, rx, ry, rz].
- **Return value:**
  - `1` : complete

14.2 `get_tool_reference(coords)`

- **function:** Get tool coordinate system.
- **Return value:** (`list`) [x, y, z, rx, ry, rz]

14.3 `set_world_reference(coords)`

- **function:** Set world coordinate system.
- **Parameters：**
  - `coords` : (`list`) [x, y, z, rx, ry, rz].
- **Return value:**
  - `1` : complete

14.4 `get_world_reference()`

- **function:** Get world coordinate system.
- **Return value:** `list` [x, y, z, rx, ry, rz].

14.5 `set_reference_frame(rftype)`

- **function:** Set base coordinate system.
- **Parameters：** `rftype` : 0 - base 1 - tool.
- **Return value:**
  - `1` : complete

14.6 `get_reference_frame()`

- **function:** Get base coordinate system.
- **Return value:** (`list`) [x, y, z, rx, ry, rz].

14.7 `set_movement_type(move_type)`

- **function:** Set movement type.
- **Parameters：**
  - `move_type` : 1 - movel, 0 - moveJ.
- **Return value:**
  - `1` : complete

14.8 `get_movement_type()`

- **function:** Get movement type.
- **Return value:**
  - `1` - movel
  - `0` - moveJ

14.9 `set_end_type(end)`

- **function:** Set end coordinate system
- **Parameters:**
  - `end (int)` : `0` - flange, `1` - tool
- **Return value:**
  - `1` : complete

14.10 `get_end_type()`

- **function:** Obtain the end coordinate system
- **Return value:**
  - `0` - flange
  - `1` - tool

15. Raspberry pi -- GPIO

15.1 `gpio_init()`

- **function**: Init GPIO module, and set BCM mode.
- **Return value:**
  - `1` : complete

15.2 `gpio_output(pin, v)`

- **function**: Set GPIO port output value.
- **Parameters**
  - `pin` (`int`) Pin number.
  - `v` (`int`): 0 / 1
- **Return value:**
  - `1` : complete

16. utils (module)

This module supports some helper methods. Use the code entered at the beginning of the file to import the module:

```
from pymycobot import utils
```

16.1 `utils.get_port_list()`

- **Function**: Get a list of all current serial port numbers
- **Return value:** Serial port list (`list`)

16.2 `utils.detect_port_of_basic()`

- **Function**: Return the first detected serial port number of M5 Basic. (Only one serial port number will be returned)
- **Return value:** Return the detected port number. If no serial port number is detected, it will return: None

MyCobot 280 Socket

> Note: raspberryPi version Only supports python3 The robotic arm that uses this class of premise has a server and has been turned on.

Use TCP/IP to control the robotic arm

1. Client

```
# demo
from pymycobot import MyCobot280Socket
# Port 9000 is used by default
mc = MyCobot280Socket("192.168.10.10",9000)

res = mc.get_angles()
print(res)

mc.send_angles([0,0,0,0,0,0],20)
...
```

2. Server

Server file is in the `demo folder` ,For details, please check the Server_280.py file in the demo folder

3. socket control

> Note: Most of the methods are the same as the class MyCobot280, only the new methods are listed here.

3.1 `set_gpio_mode(mode)`

- **function**: Set pin coding method.
- **Parameters**
  - `mode` (`str`) "BCM" or "BOARD".

3.2 `set_gpio_out(pin_no, mode)`

- **function**: Set the pin as input or output.
- **Parameters**
  - `pin_no` (`int`) pin id.
  - `mode` (`str`) "in" or "out"

3.3 `set_gpio_output(pin_no, state)`

- **function**: Set the pin to high or low level.
- **Parameters**
  - `pin_no` (`int`) pin id.
  - `state` (`int`) 0 or 1

3.4 `get_gpio_in(pin_no)`

- **function**: Get pin level status.
- **Parameters**
  - `pin_no` (`int`) pin id.

- **Return value:** `0` is low level `1` is high level

Joint Control

For serial multi-joint robots, the control of joint space is to control the variables of each joint of the robot, and the goal is to make each joint of the robot reach the target position at a certain speed.

> **Note:** When setting the angle, the limit of different series of robot arms is different. For details, please refer to the parameter introduction of the corresponding model.

Single joint control

send_angle(id, degree, speed)

- **Function:** Send the specified single joint movement to the specified angle
- **Parameter description:**
  - `id` : Represents the joint of the robot arm. Use numbers 1-6 to represent it.
  - `degree` : Represents the angle of the joint
  - `speed` : Represents the speed of the robot arm movement, ranging from 1 to 100
- **Return value:** 1

set_encoder(joint_id, encoder, sp)

- **Function:** Send the specified single joint movement to the specified potential value
- **Parameter description:**
  - `joint_id` : Represents the joint of the robot arm. Use numbers 1-6 to represent it.
  - `encoder` : represents the potential value of the robot arm, the value range is 0 ~ 4096
  - `sp` : Indicates the speed of the robot arm movement, ranging from 1 to 100
- **Return value:** 1

Multi-joint control

get_angles()

- **Function:** Get all joint angles
- **Return value:** `list` A list of floating point values, representing the angles of all joints

send_angles(degrees, speed)

- **Function:** Send all angles to all joints of the robot arm
- **Parameter description:**
  - `degrees` : `(List[float])` contains the angles of all joints. the representation is: `[20,20,20,20,20,20]`
  - `speed` : Indicates the speed of the robot arm, the value range is 1-100
- **Return value:** None

set_encoders(encoders, sp)

- **Function:** Send potential values to all joints of the robot arm
- **Parameter description:**
  - `encoder` : Indicates the potential value of the robot arm, the value range is 0 ~ 4096, the length is 6, representation method is: `[2048,2048,2048,2048,2048,2048]`
  - `sp` : Indicates the speed of the robot arm, the value range is 1-100

- **Return value:** 1

sync_send_angles(degrees, speed, timeout=15)

- **Function:** Synchronously send angles and return when reaching the target point
- **Parameter description:**
  - `degrees` : List of angle values of each joint `List[float]`
  - `speed` : (`int`) The speed of the robot arm, the value range is 1-100
  - `timeout` : The default time is 15s
- **Return value:** 1

get_radians()

- **Function:** Get the radians of all joints
- **Return value:** `list` contains a list of all joint radian values

send_radians(radians, speed)

- **Function:** Send radian values to all joints of the robot arm
- **Parameter description:**
  - `radians` : `list` Indicates the radian value of the robot arm, the value range is -5~5
- **Return value:** 1

Example use

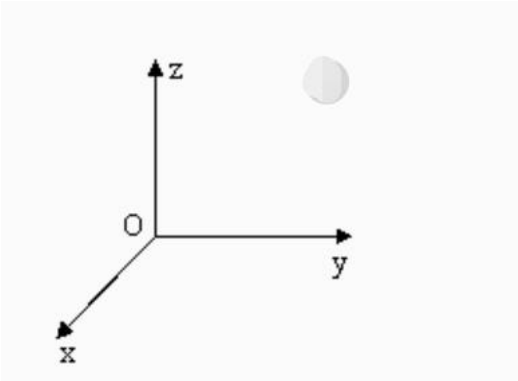
```
from pymycobot.mycobot280 import MyCobot280
import time

# MyCobot280 Class initialization requires two parameters: serial and baud rate

# Initialize a MyCobot280 object
# Here is the object code for the windows version
mc = MyCobot280("/dev/ttyAMA0", 1000000)
# By passing the angle parameter, each joint of the robot arm moves to the corresponding position [0, 0, 0, 0, 0, 0]
mc.send_angles([0, 0, 0, 0, 0, 0], 50)

# Set the waiting time to ensure that the robot has reached the specified position
time.sleep(2.5)

# Move joint 1 to the position of 90
mc.send_angle(1, 90, 50)

# Set the waiting time to ensure that the robot has reached the specified position
time.sleep(2)

# The following code can make the robot swing left and right
# Set the number of loops
num=5
while num > 0:
    # Move joint 2 to the position of 50
    mc.send_angle(2, 50, 50)

    # Set the waiting time to ensure that the robot has reached the specified position
    time.sleep(1.5)

    # Move joint 2 to the position of -50
    mc.send_angle(2, -50, 50)

    # Set the waiting time to ensure that the robot has reached the specified position
    time.sleep(1.5)

    num -= 1

# Retract the robot arm. You can swing the robot arm manually, and then use the get_angles() function to get the coordinat
# Use this function to make the robot arm reach the position you want.
mc.send_angles([88.68, -138.51, 155.65, -128.05, -9.93, -15.29], 50)

# Set the waiting time to ensure that the robot arm has reached the specified position
time.sleep(2.5)
```

```
# Relax the robot arm and swing it manually
mc.release_all_servos()
```

Coordinate control

It is mainly used to realize intelligent route planning to let the robot arm move from one position to another specified position. It is divided into `[x, y, z, rx, ry, rz]`, where `[x, y, z]` represents the position of the robot head in space (the coordinate system is the rectangular coordinate system), and `[rx, ry, rz]` represents the posture of the robot head at this point (the coordinate system is the Euler coordinate system). The implementation of the algorithm and the representation of Euler coordinates require certain academic knowledge. We will not explain it too much here. As long as we understand the rectangular coordinate system, we can use this function well.

> **Note:** When setting coordinates, different series of robot arm joint structures are different. For the same set of coordinates, different series of robot arms will show different postures.



Single parameter coordinate

send_coord(id,coord,speed)

- **Function:** Send a single coordinate value to the robot for movement
- **Parameter description:**
  - `id` : Represents the coordinate of the robot. Represented by numbers 1-6,for example, the X axis can be filled in 1, the Y can be filled in 2, and so on
  - `coord` : Enter the coordinate value you want to reach
  - `speed` : Indicates the speed of the robot movement, the range is 1-100
- **Return value:** 1

Multi-parameter coordinates

get_coords()

- **Function:** Get current coordinates and posture
- **Return value:** `list` contains a list of coordinates and postures, length is 6, in order `[x, y, z, rx, ry, rz]`

send_coords(coords, speed, mode)

- **Function:** Send the overall coordinates and posture, and let the robot head move from the original point to the point you specify.
- **Parameter description:**
  - `coords` : [x,y,z,rx,ry,rz] coordinate value, length is 6
  - `speed` : Indicates the speed of the robot movement, the range is 1-100

- `mode` : (`int`): The value is limited to 0 and 1.
  - 0 means that the path of the robot head is nonlinear, that is, the route is randomly planned, as long as the robot head moves to the specified point while maintaining the specified posture.
  - 1 means that the path of the robot head is linear, that is, the intelligent planning route allows the robot head to move to the specified point in a straight line.
- **Return value:** 1

set_tool_reference(coords)

- **Function:** Set the tool coordinate system.
- **Parameter description:**
  - `coords` :
    - Six axes: [x,y,z,rx,ry,rz] coordinate values, length 6, x,y,z range -280 ~ 280, rx,ry,yz range -314 ~ 314
- **Return value:** 1

get_tool_reference()

- **Function:** Get the tool coordinate system.
- **Return value:** Return a coordinate list with a length of 6

get_world_reference()

- **Function:** Get the world coordinate system.
- **Return value:** Return a coordinate list with a length of 6

set_world_reference(coords)

- **Function:** Set the world coordinate system.
- **Parameter description:**
  - `coords` :
    - Six axes: [x,y,z,rx,ry,rz] coordinate values, length is 6, x,y,z range is -280 ~ 280, rx,ry,yz range is -314 ~ 314
- **Return value:** 1

set_reference_frame(rftype)

- **Function:** Set the base coordinate system.
- **Parameter description:**
  - `rftype` : 0 - base coordinate system (default), 1 - world coordinate system
- **Return value:** 1

get_reference_frame()

- **Function:** Get the base coordinate system.
- **Return value:** 0 - base coordinate system, 1 - world coordinate system, -1 - communication failed

set_end_type(end)

- **Function:** Set the end coordinate system.
- **Parameter description:**
  - `end` : 0 - flange (default), 1 - tool
- **Return value:** 1

get_end_type()

- **Function:** Get the end coordinate system.
- **Return value:** 0 - flange (default), 1 - tool, -1 - communication failed

Example use

```
from pymycobot.mycobot280 import MyCobot280
import time

# MyCobot280 class initialization requires two parameters: serial and buad rate

# Initialize a MyCobot280 object
# The following is the object code for the Windows version
mc = MyCobot280("/dev/ttyAMA0", 1000000)

if mc.get_fresh_mode() != 1:
  mc.set_fresh_mode(1)

# Get the current head coordinates and posture
coords = mc.get_coords()
print(coords)
# # Intelligently plan the route, so that the head reaches the coordinates [57.0, -107.4, 316.3] in a linear manner, and m
mc.send_coords([57.0, -107.4, 316.3, -93.81, -12.71, -163.49], 80, 1)

# Set the waiting time to 1.5 seconds
time.sleep(1.5)

# Intelligently plan the route, let the head reach the coordinates [-13.7, -107.5, 223.9] in a linear manner, and maintain
mc.send_coords([-13.7, -107.5, 223.9, 165.52, -75.41, -73.52], 80, 1)

# Set the waiting time to 1.5 seconds
time.sleep(1.5)

# Only change the x coordinate of the head, set the x coordinate of the head to -40. Let it intelligently plan the route a
mc.send_coord(1, -40, 70)
```

IO control

IO is the input and output of data. There are multiple pins on the Basic and Atom of our robot arm. The input and output modes can be set through the following function interface.

- **myCobot：**

Basic IO

get_basic_input(pin_no)

- **Function:** Get the working status of the bottom pin number
- **Parameter description:** `pin_no` : Indicates the specific pin number at the bottom of the robot
- **Return value:** `pin_signal` (`int`) When the returned value is 0, it means it is running in the working state, and 1 means it is stopped

set_basic_output(pin_no, pin_signal)

- **Function:** Set the working status of the bottom pin number
- **Parameter description:**
  - `pin_no` (`int`) The number marked on the bottom of the device only takes the digital part
  - `pin_signal` (`int`): Input 0 means set to running state, input 1 means stop state
- **Return value:** None

get_tof_distance()

- **Function:** Get the detected distance (external distance detector is required)
- **Return value:** Detected distance value, unit is mm

Atom IO

set_pin_mode(pin_no, pin_mode)

- **Function:** Set the state mode of the specified pin in atom
- **Parameter description:**
  - `pin_no` (int): The specific pin number on the top of the robot
  - `pin_mode` (int): Limited to 0~2
    - 0 is set to running state

    - 1 is set to stop state
    - 2 is set to pull-up mode
- **Return value:** 1

set_digital_output(pin_no, pin_signa)

- **Function:** Set the working state of the end pin number
- **Parameter description:**
    - `pin_no` (`int`) The number marked at the end of the device only takes the digital part
    - `pin_signal` (`int`): Enter 0 to set it to running state, enter 1 to stop state
- **Return value:** 1

get_digital_input(self, pin_no)

- **Function:** Get the working state of the end pin number
- **Parameter description:** `pin_no` : Indicates the specific pin number at the end of the robot
- **Return value:** `pin_signal` (`int`) When the returned value is 0, it means running in working state, and 1 means stop state

Raspberry Pi - GPIO

When your robot is a Raspberry Pi version, you can use the following API

Usage:

Enter the code import at the beginning of the file:

```
from pymycobot import MyCobot280
import RPi.GPIO as GPIO
```

gpio_init()

- **Function:** Initialize the GPIO module and set the BCM mode
- **Return value:** 1

set_gpio_mode

- **Function:** Set the Raspberry Pi GPIO pin mode
- **Parameter**
- `mode` (`str`) Input: "BCM" or "BOARD" to enter the corresponding mode

set_gpio_output(pin_no, state)

- **Function:** Set the pin to high or low level
- **Parameter description:**
- `pin` (`int`) Pin number
- `state` : 0 is set to low level 1 is set to high level (low level of suction pump starts working, high level stops working)
- **Return value:** 1

get_gpio_in(pin_no)

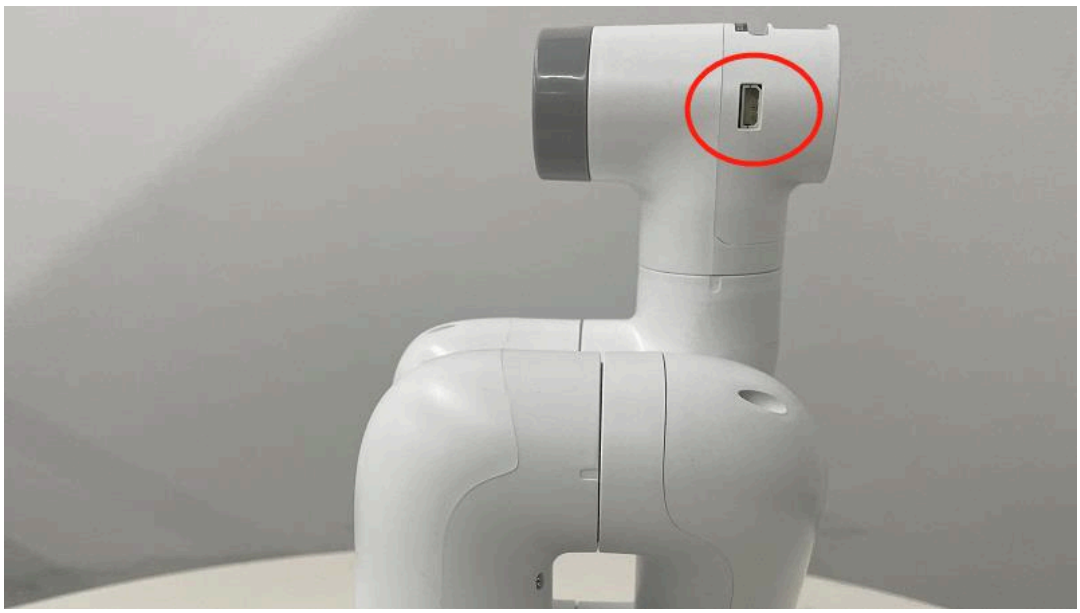
- **Function:** Get pin level status
- **Parameter description:**
- `pin_no` (`int`) Pin number
- **Return value:** 0 is low level 1 is high level

Case use

```
from pymycobot.mycobot import MyCobot280
import time
import RPi.GPIO as GPIO
#Enter the above code to import the packages required for the project

# MyCobot class initialization requires two parameters: serial and baud rate

# Initialize a MyCobot object
# Below is Raspberry Pi version of the object code
mc = MyCobot("/dev/ttyAMA0", 1000000)

# Initialization
GPIO.setmode(GPIO.BCM)
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)
# Turn on the pump
GPIO.output(20, 0)

# Wait 2 seconds
time.sleep(2)
# Turn off the pump
GPIO.output(20, 1)
time.sleep(0.05)
GPIO.output(21, 0)
time.sleep(1)
GPIO.output(21, 1)
time.sleep(0.05)
```

Gripper control

Before using Python to control the gripper, you need to install and connect the gripper on the robot arm. Different grippers are compatible with different robots (for specific adaptation information, please refer to **Product accessories**.)

> **Note:**
>
> MyCobot 280 adaptive gripper inserts the gripper into the pins on the Atom, see the following figure:
>
> 

Gripper control

`is_gripper_moving()`

- **Function:** Determine whether the gripper is running
- **Return value:**
  - `0` : Indicates that the gripper of the robot arm is not running
  - `1` : Indicates that the gripper of the robot arm is running
  - `-1` : Indicates an error

`set_gripper_state(flag, speed, _type_1=None, is_torque=None)`

- **function**: Adaptive gripper enable
- **Parameters**:
  - `flag (int)` : 0 - open 1 - close, 254 - release
  - `speed (int)` : 0 ~ 100
  - `_type_1 (int)` :
    - `1` : Adaptive gripper (default state is 1)
    - `2` : A nimble hand with 5 fingers
    - `3` : Parallel gripper
    - `4` : Flexible gripper

- `is_torque (int)` : Whether the gripper is force-controlled. This parameter can be omitted if no type parameter is specified. (**Note: This parameter is only supported when the end-end Atom firmware version is ≥ 6.5**)
  - `0` : Non-force-controlled gripper
  - `1` : Force-controlled gripper
- **Return value**:
  - `1` : complete

`set_gripper_value(gripper_value, speed, gripper_type=None, is_torque=None)`

- **function**: Set the gripper value
- **Parameters**:
  - `gripper_value (int)` : 0 ~ 100
  - `speed (int)` : 0 ~ 100
  - `gripper_type (int)` :
    - `1` : Adaptive gripper (default state is 1)
    - `3` : Parallel gripper
    - `4` : Flexible gripper
  - `is_torque (int)` : Whether the gripper is force-controlled. This parameter can be omitted if no type parameter is specified. (**Note: This parameter is only supported when the end-end Atom firmware version is ≥ 6.5**)
    - `0` : Non-force-controlled gripper
    - `1` : Force-controlled gripper
- **Return value**:
  - `1` : complete

`get_gripper_value(gripper_type=None)`

- **Function:** Get the current position data information of the gripper
- **Parameter description:**
  - `gripper_type` : gripper type, the default is adaptive gripper
    - `1` : adaptive gripper
    - `3` : parallel gripper
    - `4` : flexible gripper
- **Return value:** Gripper data information

`set_HTS_gripper_torque(torque)`

- **Function:** Set adaptive gripper torque
- **Parameter description:**
- `torque` : 150 ~ 900
- **Return value:** 0 - Setting failed; 1 - Setting successful

`get_HTS_gripper_torque()`

- **Function:** Get adaptive gripper torque

- **Return value:** 150 ~ 900

`get_gripper_protect_current()`

- **Function:** Get the gripper protection current
- **Return value:** 1 ~ 500

`init_gripper()`

- **Function:** Initialize the gripper
- **Return value:** 0 - Initialization failed; 1 - Initialization successful

`set_gripper_protect_current(current)`

- **Function:** Set the gripper protection current
- **Parameter description:**
- `current` : 1 ~ 500
- **Return value:** 0 - Initialization failed; 1 - Initialization successful

Example

```
from pymycobot.mycobot280 import MyCobot280
import time
#Enter the above code to import the packages required for the project

def gripper_test(mc):
print("Start check IO part of api\n")
# Check if the gripper is moving
flag = mc.is_gripper_moving()
print("Is gripper moving: {}".format(flag))
time.sleep(1)
# Set the current position to (2048).
# Use it when you are sure you need it.
# Gripper has been initialized for a long time. Generally, there
# is no need to change the method.
# mc.set_gripper_ini()
# Set joint point 1 and let it rotate to the position 2048, speed 20
mc.set_encoder(1, 2048, 20)
time.sleep(2)
# Set six joint positions and let the robot arm rotate to this position at a speed of 20
mc.set_encoders([1024, 1024, 1024, 1024, 1024, 1024], 20)
time.sleep(3)

# Let the gripper reach the 100 state at a speed of 70
mc.set_gripper_value(100, 70)
time.sleep(3)
# Let the gripper reach the 0 state at a speed of 70
mc.set_gripper_value(0, 70)
time.sleep(3)

# Set the state of the gripper to open the claw quickly at a speed of 70
mc.set_gripper_state(0, 70)
time.sleep(3)

# Set the state of the gripper to close the claw quickly at a speed of 70
mc.set_gripper_state(1, 70)
time.sleep(3)

# Get the value of the gripper
print("")
print(mc.get_gripper_value())

if __name__ == "__main__":
# MyCobot280 class initialization requires two parameters: serial and baud rate

# Initialize a MyCobot280 object
# Below is the object code for M5 version
mc = MyCobot280('/dev/ttyAMA0', 1000000)
# Move it to zero
```

```
mc.set_encoders([2048, 2048, 2048, 2048, 2048, 2048], 20)
time.sleep(3)
gripper_test(mc)
```

TCP/IP

TCP/IP transmission protocol, namely transmission control/network protocol, is also called network communication protocol. It is the most basic communication protocol in the use of the network, and stipulates the standards and methods for communication between various parts of the Internet. Users can connect to the robot arm through the IP address of the robot arm, so that the robot arm can be remotely operated without connecting to the USB port.

myCobot

myCobot Raspberry Pi system remote connection

- When using Raspberry Pi remote connection, please note the following points
- Raspberry Pi and control end need to be in the same network
- The server file(change to Server_280.py) needs to be executed in Raspberry Pi first (see the gif operation diagram below for specific operations)
- After the server file is executed, the prompts "Binding succeeded" and "waiting connect" indicate that the start is successful. The control end can refer to **Case** for control

Specific operations:

Clone our project library: `git clone https://github.com/elephantrobotics/pymycobot.git`

Found in the demo folder Server_280.py file

Please change the parameters passed in the last line of MyCobotServer in the Server.py file according to your machine model.

- The default model is 280PI.
- The default parameters are:
- serial_num: /dev/ttyAMA0

- baud: 1000000

Use python to execute

Case

Run on the PC:

```
from pymycobot import MyCobot280Socket
# Default port is 9000
#"172.20.10.14" is the IP of the robot arm, please enter your own IP of the robot arm
mc = MyCobot280Socket("172.20.10.14",9000)

#If the connection is normal, you can control the robot arm
mc.send_angles([0,0,0,0,0,0],20)
res = mc.get_angles()
print(res)

...
```

Handle control

You can use the game controller to control the movement of the machine and use the gripper or suction pump to grab objects.

> Note: The handle needs to be purchased separately, please contact the official customer service for details

The corresponding functions of the handle buttons are as follows:

myCobot:

- **1**: RX coordinate value increases
- **2**: RX coordinate value decreases
- **3**: RY coordinate value increases
- **4**: RY coordinate value decreases
- **5**: X coordinate value increases
- **6**: X coordinate value decreases

- **7**: Y coordinate value decreases
- **8**: Y coordinate value increases
- **9**: Z coordinate value decreases
- **10**: Z coordinate value increases
- **11**: RZ coordinate value decreases
- **12**: RZ Coordinate value increases
- **13**: Wake up the handle. If the handle is not used for a long time after connection, it will enter sleep mode. You need to press this button to continue using it.
- **X**: Click the button to open the jaws
- **Y**: Click the button to close the jaws
- **A**: Click the button to turn on the suction pump
- **B**: Click the button to turn off the suction pump
- **Left 1**: Press and hold for 2s to initialize the robot to the joint zero position state.
- **Left 2**: Press and hold for 2s, the robot stops torque output and relaxes all joints.
- **Right 1**: Press and hold for 2s to initialize the robot to the initial point of movement.
- **Right 2**: Press and hold for 2s, the robot turns on torque output and all joints are locked.

Instructions for use

1. Connect the device

Connect MyCobot and the handle to the computer.

2. Install the required packages

Download code: https://github.com/elephantrobotics/pymycobot

Open the terminal, switch the path to the `pymycobot/demo/handle_control` folder, and run the following command:

```
pip3 install -r requirements.txt
```

3. Change the port number

myCobot

Edit the myCobot280_handle_control.py file

```
import pygame
import time
from pymycobot import MyCobot280
import threading


mc = MyCobot280("/dev/ttyAMA0", 1000000)
...
```

Run the program.

```
python3 myCobot280_handle_control.py
```

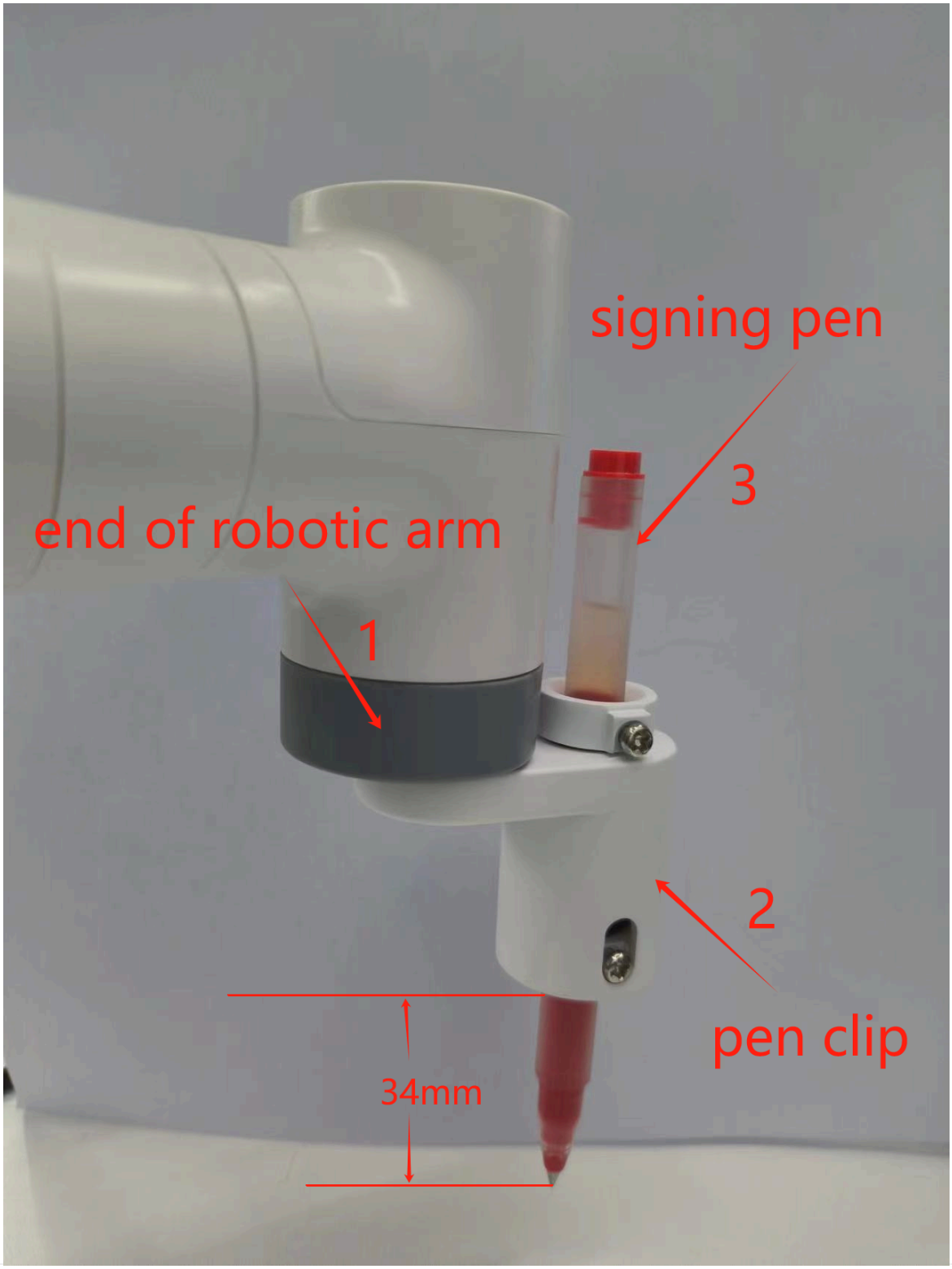
> Note: After running the program, first click the **Right 1** button. After the machine reaches the initial point, other operations can be performed.

Draw a pattern

You can control the movement of the robot arm and realize the drawing operation by parsing the instructions in a gcode file.

Installation diagram

> Note: The end of the robot arm and the pen clip are connected using Lego technology.



Instructions

1. Connect the device

Connect MyCobot to the computer, install the pen clip to the end of the robot arm, put the signature pen in the pen clip and tighten the screws to fix it.

> Note: Use the G-type base 2.0 to fix the robot arm on the desktop, and place the A4 white paper on the desktop for drawing patterns.

2. Install the required packages

Download code: https://github.com/elephantrobotics/pymycobot

Open the terminal, switch the path to the `pymycobot/demo/myCobot_280_demo` folder, and run the following command:

```
pip install pyserial pymycobot
```

3. Change the port number

Edit the 280_draw_gcode.py file

```
# Change COM14 to the actual port number detected by your computer
import time
from pymycobot import MyCobot280 # import mycobot library,if don't have, first 'pip install pymycobot'


# use PC and M5 control
# mc = MyCobot280('COM14', 115200) # WINDOWS use, need check port number when you PC
# mc = MyCobot280('/dev/ttyUSB0',115200) # VM linux use


# PI version
mc = MyCobot280('/dev/ttyAMA0', 1000000)
time.sleep(0.5)
...
```

Just run the program.

```
python 280_draw_gcode.py
```

Then, according to the terminal prompt, enter different numbers to select different patterns:

```
1-square
2-triangle
3-five point star
4-quit
```

> Note: The initial point of the robot arm can be changed by yourself, but the posture of the J6 joint must be vertically downward, and the speed can also be changed by yourself, the default is 100 mm per second.

```
bash ...
# Send the initial point angle of the robot arm, the customized is 50,
# it can be and modified, as long as the end is facing down mc.send_angles([0, -40, -130, 80, 0, 50], 50)
# Wait 3 seconds for the robot arm to move to the specified angle time.sleep(3)
# Get the current coordinates of the robot arm get_coords = speed mc.get_co ords() time.sleep(1.5)
# Save the parsed coordinates data_coords = []
# Set the drawing speed to 100, and the speed range is 0~100 draw_speed = 100 ...
```

Demonstration code

The following are various use cases and operation result videos. You can copy the code for use or modification (the robot arm model used in the following cases is MyCobot280 280. The parameters of different series of robot arms are different. Please pay attention to the modification).

Note: The corresponding baud rates of various devices are different. Please refer to the information to understand their baud rates when using them. The serial port number can be viewed through Calculator Device Manager or the serial port assistant.

1 Control RGB light board

```
from pymycobot.mycobot280 import MyCobot280


import time
#The above needs to be written at the beginning of the code, which means importing the project package


# MyCobot280 class initialization requires two parameters: serial port and baud rate


# Initialize a MyCobot280 object
# The following is the object code for the PI version
mc = MyCobot280("/dev/ttyAMA0", 1000000)


i = 7
# Loop 7 times
while i > 0:
mc.set_color(0,0,255) #Blue light on
time.sleep(2) #Wait 2 seconds
mc.set_color(255,0,0) #Red light on
time.sleep(2) #Wait 2 seconds
mc.set_color(0,255,0) #Green light on
time.sleep(2) #Wait 2 seconds
i -= 1
```

2 Control the machine to return to the origin

```
from pymycobot.mycobot280 import MyCobot280
# MyCobot280 class initialization requires two parameters: serial and baud rate

# Initialize a MyCobot280 object
# The following is the object code for PI version
mc = MyCobot280("/dev/ttyAMA0", 1000000)

# Check if the robot can be programmed

if mc.is_controller_connected() != 1:

print("Please connect the robot correctly to write the program")

exit(0)

# Fine-tune the robot to ensure that all the ports are aligned

# The alignment of the robot port is the standard. This is just an example

mc.send_angles([0, 0, 0, 0, 0, 0], 30)

# Calibrate the position at this time. The calibrated angle position is [0,0,0,0,0,0] and the potential value is [2048,204

# This for loop is equivalent to the set_gripper_ini() method

#for i in range(1, 7):

#mc.set_servo_calibration(i)
```

3 Single joint movement

```
from pymycobot import MyCobot280
import time

# The MyCobot280 class requires two parameters to be initialized: serial and baud rate
# Create object code for PI version
mc=MyCobot280('/dev/ttyAMA0',1000000)

# Robot arm recovery
mc.send_angles([0, 0, 0, 0, 0, 0], 40)
time.sleep(3)

# Control joint 3 to move 70°
mc.send_angle(Angle.J3.value,70,40)
time.sleep(3)

# Control joint 4 to move -70°
mc.send_angle(Angle.J4.value,-70,40)
time.sleep(3)

# Control joint 1 to move 90°
mc.send_angle(Angle.J1.value,90,40)
time.sleep(3)

# Control joint 5 to move -90°
mc.send_angle(Angle.J5.value,-90,40)
time.sleep(3)

# Control joint 5 to move 90°
mc.send_angle(Angle.J5.value,90,40)
time.sleep(3)
```

4 Multi-joint exercise

```
import time
from pymycobot import MyCobot280
# The MyCobot280 class requires two parameters to be initialized: serial and baud rate
# Initialize a MyCobot280 object
# 280-PI version object code
mc=MyCobot280('/dev/ttyAMA0',1000000)
# Robot arm reset to zero
mc.send_angles([0,0,0,0,0,0],50)
time.sleep(2.5)
# Control the different angles of rotation of multiple joints
mc.send_angles([90,45,-90,90,-90,90],50)
time.sleep(2.5)
# Robot arm reset to zero
mc.send_angles([0,0,0,0,0,0],50)
time.sleep(2.5)
# Control the different angles of rotation of multiple joints
mc.send_angles([-90,-45,90,-90,90,-90],50)
time.sleep(2.5)
```

5 Control the robot arm to swing left and right

```
from pymycobot.mycobot280 import MyCobot280
import time

# PI version
mc = MyCobot280("/dev/ttyAMA0", 1000000)
# Get the coordinates of the current position
angle_datas = mc.get_angles()
print(angle_datas)

# Use a sequence to pass coordinate parameters to move the robot to the specified position
mc.send_angles([0, 0, 0, 0, 0, 0], 50)
print(mc.is_paused())
# Set the waiting time to ensure that the robot has reached the specified position
# while not mc.is_paused():
time.sleep(2.5)

# Move joint 1 to position 90
mc.send_angle(Angle.J1.value, 90, 50)

# Set the waiting time to ensure that the robot has reached the specified position
time.sleep(2)

# Set the number of loops
num = 5

# Let the robot swing left and right
while num > 0:
    # Move joint 2 to position 50
    mc.send_angle(2, 50, 50)
    # Set the waiting time to ensure that the robot has reached the specified position
    time.sleep(1.5)
    # Move joint 2 to position -50
    mc.send_angle(2, -50, 50)
    # Set the waiting time to ensure that the robot has reached the specified position
    time.sleep(1.5)
    num -= 1
# Retract the robot arm. You can swing the robot arm manually, and then use the get_angles() function to get the coordinat
# Use this function to make the robot arm reach the position you want.
mc.send_angles([88.68, -138.51, 155.65, -128.05, -9.93, -15.29], 50)

# Set the waiting time to ensure that the robot arm has reached the specified position
time.sleep(2.5)
# Relax the robot arm and swing it manually
mc.release_all_servos()
```

6 Controlling the robotic arm to dances

```
from pymycobot.mycobot280 import MyCobot280
import time


if __name__ == '__main__':
# MyCobot280 class initialization requires two parameters: serial and baud rate

# Initialize a MyCobot280 object
# PI version
 mc = MyCobot280("/dev/ttyAMA0",1000000)
# Set the start time
start = time.time()
# Let the robot reach the specified position
mc.send_angles([-1.49, 115, -153.45, 30, -33.42, 137.9], 80)
# Determine whether it has reached the specified position
while not mc.is_in_position([-1.49, 115, -153.45, 30, -33.42, 137.9], 0):
    # Let the robot resume movement
    mc.resume()
    # Let the robot move for 0.5s
    time.sleep(0.5)
    # Pause the movement of the robot
    mc.pause()
    # Determine whether the movement has timed out
    if time.time() - start > 3:
        break
# Set the start time
start = time.time()
# Let the movement last for 30 seconds
while time.time() - start < 30:
    # Let the robot reach this position quickly
    mc.send_angles([-1.49, 115, -153.45, 30, -33.42, 137.9], 80)
    # Set the color of the light to [0,0,50]
    mc.set_color(0, 0, 50)
    time.sleep(0.7)
    # Let the robot reach this position quickly
    mc.send_angles([-1.49, 55, -153.45, 80, 33.42, 137.9], 80)
    # Set the color of the light to [0,50,0]
    mc.set_color(0, 50, 0)
    time.sleep(0.7)
```

7 Gripper control

```
from pymycobot.mycobot280 import MyCobot280
import time


def gripper_test(mc):
    print("Start check IO part of api\n")
    # Check if the gripper is moving
    flag = mc.is_gripper_moving()
    print("Is gripper moving: {}".format(flag))
    time.sleep(1)

    # Set the current position to (2048).
    # Use it when you are sure you need it.
    # Gripper has been initialized for a long time. Generally, there
    # is no need to change the method.
    # mc.set_gripper_ini()
    # Set joint point 1 to rotate to position 2048, speed 20
    mc.set_encoder(1, 2048, 20)
    time.sleep(2)
    # Set six joint positions and let the robot arm rotate to the position at a speed of 20

    mc.set_encoders([1024, 1024, 1024, 1024, 1024, 1024], 20)
    # mc.set_encoders([2048, 2900, 2048, 2048, 2048, 2048], 20)
    # mc.set_encoders([2048, 3000,3000, 3000, 2048, 2048], 50)
    time.sleep(3)
    # Get the position information of joint point 1
    print(mc.get_encoder(1))
    # Set the gripper to rotate to the position of 2048
    mc.set_encoder(7, 2048, 20)
    time.sleep(3)
    # Set the gripper to rotate to the position of 1300
    mc.set_encoder(7, 1300, 20)
    time.sleep(3)

    # Let the gripper reach the state of 100 at a speed of 70
    mc.set_gripper_value(100, 70)
    time.sleep(3)
    # Let the gripper reach the state of 0 at a speed of 70
    mc.set_gripper_value(0, 70)
    time.sleep(3)

    num=5
    while num>0:
        # Set the state of the gripper to open the claws quickly at a speed of 70
        mc.set_gripper_state(0, 70)
        time.sleep(3)
        # Set the state of the gripper to close the claws quickly at a speed of 70
        mc.set_gripper_state(1, 70)
```

```
        time.sleep(3)
        num-=1


    # Get the value of the gripper
    print("")
    print(mc.get_gripper_value())
    # mc.release_all_servos()

if __name__ == "__main__":
# MyCobot280 class initialization requires two parameters: serial and baud rate

# Initialize a MyCobot280 object
# PI version
mc = MyCobot280('/dev/ttyAMA0', 1000000)
# Move it to zero position
mc.set_encoders([2048, 2048, 2048, 2048, 2048, 2048], 20)
time.sleep(3)
gripper_test(mc)
```

8 Suction pump control

280-PI

```
from pymycobot.mycobot280 import MyCobot280
import time
import RPi.GPIO as GPIO

# The MyCobot280 class requires two parameters to initialize: serial and baud rate

# Initialize a MyCobot280 object
# The following is the object code for the PI version
mc = MyCobot280('/dev/ttyAMA0',1000000)
# The position of the robot arm movement
angles = [
[92.9, -10.1, -60, 5.8, -2.02, -37.7],
[92.9, -53.7, -83.05, 50.09, -0.43, -38.75],
[92.9, -10.1, -87.27, 5.8, -2.02, -37.7]
]

# Initialization
GPIO.setmode(GPIO.BCM)
# Pin 20/21 controls the solenoid valve and the exhaust valve respectively
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)
# Turn on the suction pump
def pump_on():
    # Open the solenoid valve
    GPIO.output(20,0)

# Stop the suction pump
def pump_off():
    # Close the solenoid valve
    GPIO.output(20,1)
    time.sleep(0.05)
    # Open the exhaust valve
    GPIO.output(21,0)
    time.sleep(1)
    GPIO.output(21,1)
    time.sleep(0.05)

# Robot arm recovery
mc.send_angles([0, 0, 0, 0, 0, 0], 30)
time.sleep(3)

# Turn on the suction pump
pump_on()
mc.send_angles(angles[2], 30)
time.sleep(2)

# Suction small objects
mc.send_angles(angles[1], 30)
time.sleep(2)
mc.send_angles(angles[0], 30)
```

```
time.sleep(2)
mc.send_angles(angles[1], 30)
time.sleep(2)
#Turn off the suction pump
pump_off()
mc.send_angles(angles[0], 40)
time.sleep(1.5)
```

Introduction to ROS

ROS is an open source meta-operating system for robots. It provides the services that an operating system should have, including hardware abstraction, low-level device control, implementation of common functions, messaging between processes, and package management. It also provides the tools and library functions needed to obtain, compile, write, and run code across computers.

The "graph" of the ROS runtime is a loosely coupled point-to-point process network based on the ROS communication infrastructure. ROS implements several different communication methods, including services based on synchronous RPC-style communication, topics based on asynchronous streaming data, and parameter servers for data storage.

ROS is not a real-time framework, but ROS can be embedded in real-time programs. Willow Garage's PR2 robot uses a system called pr2_etherCAT to send or receive ROS messages in real time. ROS can also be seamlessly integrated with the Orocos real-time toolkit.

Design goals and features of ROS

Many people ask "What is the difference between ROS and other robotics software platforms?" This is a difficult question to answer. Because ROS is not a framework that integrates most functions or features. In fact, the main goal of ROS is to support code reuse for robotics research and development. ROS is a framework of distributed processes (i.e. nodes) that are packaged in packages and function packages that are easy to share and distribute.

ROS also supports a federated system similar to a code repository, which also enables collaboration and distribution of projects. This design allows the development and implementation of a project to be completely independent of decisions (not limited by ROS) from the file system to the user interface. At the same time, all projects can be integrated with the basic tools of ROS.

In order to support the main goal of sharing and collaboration, the ROS framework has several other characteristics:

- Lean: ROS is designed to be as lean as possible so that code written for ROS can be used with other robotics software frameworks. A corollary to this is that ROS can be easily integrated with other robotics software platforms: ROS has been integrated with OpenRAVE, Orocos and Player.
- ROS-insensitive libraries: The preferred development model of ROS is written in clean library functions that do not depend on ROS.
- Language independence: The ROS framework can be easily implemented in any modern programming language. ROS has implemented Python version, C++ version and Lisp version. It also has Java and Lua version experimental libraries.
- Loose coupling: The function modules in ROS are encapsulated in independent function packages or meta-function packages for easy sharing. The modules in the function package run as nodes and use ROS standard IO as the interface. Developers do not need to pay attention to the internal implementation of the module. As long as they understand the interface rules, they can reuse it, realizing point-to-point loose coupling connection between modules
- Convenient testing: ROS has a built-in unit/integration test framework called rostest, which can easily install or uninstall test modules.
- Scalable: ROS can be applied to large runtime systems and large development processes.
- Free and open source: many developers and many function packages

Why use ROS

Through ROS, we can realize the simulation control of the robot arm in a virtual environment.

We will use the **rviz** platform to realize the visualization of the robot arm and use a variety of methods to operate our robot arm; through the **moveit** platform to plan and execute the robot arm's action path, we can achieve the effect of free control of the robot arm.

In the next chapter, we will learn how to control our products through the platform in ros.

ROS1 Tutorial Guide

Environment Building

ROS1 Basics

rviz Introduction and Use

moveit Introduction and Use

ROS environment setup

Raspberry Pi version:

The Raspberry Pi version comes with Ubuntu (V-20.04) system and built-in development environment. No setup and management is required. Just update the `mycobot_ros` package.

`mycobot_ros` is a ROS1 package for the mycobot series of desktop six-axis robotic arms launched by Elephant Robotics.

ROS1 project address: http://github.com/elephantrobotics/mycobot_ros

Robot arm API driver library address: https://github.com/elephantrobotics/pymycobot

Update mycobot_ros package

To ensure that users can use the latest official package in a timely manner, you can go to the `/home/er/catkin_ws/src` folder through the file manager, open the console terminal (shortcut `Ctrl`+`Alt`+`T`), and enter the following command to update:

```
# Clone the code on github
cd ~/catkin_ws/src
git clone https://github.com/elephantrobotics/mycobot_ros.git # Before deciding whether to execute this command, please ch
cd .. # Return to the workspace
catkin_make # Build the code in the workspace
source devel/setup.bash # Add environment variables
```

Note: If the `mycobot_ros` folder already exists in the `/home/er/catkin_ws/src (equivalent to ~/catkin_ws/src)` directory, you need to delete the original `mycobot_ros` first, and then execute the above command. Among them, `er` in the directory path is the system user name. If there is any inconsistency, please modify it.

At this point, the ROS1 environment is set up.

Service and Topic

Service

> Note: myCobot Pro 600 and myCobot Pro 630 devices do not support Service usage.

Service is a request-response communication mechanism. One node can provide a service, and another node can request the service and wait for a response. Services are usually used to perform time-consuming operations or tasks that require interaction, such as performing calculations and obtaining data.

Related commands and instructions:

Command	Detailed description
rosservice list	Display active service information
rosservice info [service name]	Display information of a specified service
rosservice type [service name]	Display service type
rosservice find [service type]	Find services of a specified service type
rosservice uri [service name]	Display ROSRPC URI services
rosservice args [service name]	Display service parameters
rosservice call [service name] [parameters]	Request services with input parameters

Topic

Topic is a communication mechanism in publish-subscribe mode. Nodes can publish messages to a topic or subscribe to a topic to receive messages. Multiple nodes can publish and subscribe to the same topic at the same time to broadcast and receive information. Topic is mainly used for data transmission with low real-time requirements, such as sensor data, status information, etc.

Related commands and instructions:

Command	Detailed description
rostopic list	Display the active topic directory
rostopic echo [topic name]	Display the message content of the specified topic in real time
rostopic find [type name]	Display topics using the specified type of message
rostopic type [topic name]	Display the message type of the specified topic
rostopic bw [topic name]	Display the message bandwidth of the specified topic
rostopic hz [topic name]	Display the message data publishing cycle of the specified topic
rostopic info [topic name]	Display the information of the specified topic
rostopic pub [topic name] [message type] [parameters]	Publish a message with the specified topic name

Difference between service and topic:

	topic	service
Synchronicity	Asynchronous	Synchronous
Communication model	Publish/Subscribe	Request/Response
Underlying protocol	ROSTCP/ROSUDP	ROS service protocol RPC
Feedback mechanism	No	Yes
Buffer	Yes	No
Real-time	Weak	Strong
Node relationship	Many-to-many	One-to-many
Applicable scenarios	Data transmission	Logical processing

You can go to service and topic to learn more about the use of these two functions

Introduction to msg and srv

- msg: msg files are simple text files that describe the fields of ROS messages. They are used to generate source code for messages in different languages (c++ or python, etc.).
- srv: srv files are used to describe services. It consists of two parts: request and response. msg files are stored in the msg directory of the package, while srv files are stored in the srv directory.

rosmsg

rosmsg is a command-line tool for displaying information about ROS message types.

rosmsg demo:

```
rosmsg show # Display message description
rosmsg info # Display message information
rosmsg list # List all messages
rosmsg md5 # Display md5 encrypted messages
rosmsg package # Display all messages under a certain function package
rosmsg packages # List function packages containing messages
```

- rosmsg list Will list all msg in the current ROS
- rosmsg packages List all packages containing messages
- rosmsg package List all msg under a certain package

```
//rosmsg package # Package name
rosmsg package turtlesim
```

- rosmsg show Display message description

```
//rosmsg show # Message name
rosmsg show turtlesim/Pose
# Result:
float32 x
float32 y
float32 theta
float32 linear_velocity
float32 angular_velocity
```

- rosmsg info Same as rosmsg show
- rosmsg md5 A verification algorithm to ensure the consistency of data transmission

rossrv

rossrv is a command line tool used to display information about ROS service types, and its syntax is highly similar to rosmsg.

```
rossrv show # Display service message details
rossrv info # Display service message related information
rossrv list # List all service information
rossrv md5 # Display md5 encrypted service message
rossrv package # Display all service messages under a certain package
rossrv packages # Display all packages containing service messages
```

- rossrv list Will list all srv messages in the current ROS
- rossrv packages List all packages containing service messages
- rossrv package List all msg under a certain package

```
//rossrv package # Package name
rossrv package turtlesim
```

- rossrv show Display message description

```
//rossrv show # Message name
rossrv show turtlesim/Spawn
# Result:
float32 x
float32 y
float32 theta
string name
---
string name
```

- rossrv info The same function as rossrv show
- rossrv md5 Use md5 verification (encryption) for service data

Introduction to URDF

- Unified Robot Description Format, abbreviated as URDF. The urdf function package in ROS contains a C++ parser for URDF. The URDF file uses XML format to describe the robot model.
- URDF cannot be used alone and needs to be combined with Rviz or Gazebo. URDF is just a file that needs to be rendered into a graphical robot model in Rviz or Gazebo.

urdf file description

Code example:

Here only part of the code is intercepted for display:

```
<?xml version="1.0"?>
<robot  xmlns:xacro="http://www.ros.org/wiki/xacro" name="mycobot_ai_with" >

  <xacro:property name="width" value=".2" />

  <link name="env">
  <inertial>
    <origin xyz="0 0 0" rpy="0 0 0"/>
      <mass value="10"/>
      <inertia
        ixx="1.0" ixy="0.0" ixz="0.0"
        iyy="1.0" iyz="0.0"
        izz="1.0"/>
  </inertial>
    <visual>
      <geometry>
         <!--- 0.0 0 -0.04  1.5708 3.14159-->
       <mesh filename="package://mycobot_description/urdf/mycobot/suit_env.dae"/>
      </geometry>
      <origin xyz = "0 0 0.0" rpy = "1.5708 0 -1.5708"/>
    </visual>
  </link>

  <link name="joint1">
    <inertial>
    <origin xyz="0 0 0.1" rpy="0 0 0"/>
      <mass value="0.2"/>
      <inertia
        ixx="1.0" ixy="0.0" ixz="0.0"
        iyy="1.0" iyz="0.0"
        izz="1.0"/>
  </inertial>
    <visual>
      <geometry>
         <!--- 0.0 0 -0.04  1.5708 3.14159-->
       <mesh filename="package://mycobot_description/urdf/mycobot/joint1.dae"/>
      </geometry>
      <origin xyz = "0.0 0 0.02 " rpy = " 0 0 -1.5708"/>
    </visual>
    <collision>
      <geometry>
         <!--- 0.0 0 -0.04  1.5708 3.14159-->
       <mesh filename="package://mycobot_description/urdf/mycobot/joint1.dae"/>
        </geometry>
        <origin xyz = "0.0 0 0.02 " rpy = " 0 0 -1.5708"/>
    </collision>
  </link>

  <joint name="vision_joint" type="fixed">
    <axis xyz="0 0 0"/>
```

```
    <limit effort = "1000.0" lower = "-3.14" upper = "3.14159" velocity = "0"/>
    <parent link="env"/>
    <child link="joint1"/>
    <origin xyz= "0 0 0" rpy = "0 0 0"/>
  </joint>

<link name="world"/>
<joint name="fixed" type="fixed">
  <parent link="world"/>
  <child link="env"/>
</joint>

</robot>
```

It can be seen that the urdf file is not complicated, mainly composed of the two parts of `link` and `joint` that are repeated continuously.

Link section

The link element describes a rigid body with inertia, visual characteristics, and collision properties

Attributes

name:

Name used to describe the link itself

Elements

- `<inertial>` (optional)
- Inertial properties of the link
- `<origin>` (optional, defaults to identity if not specified)
- Defines the reference coordinates of the inertial reference frame relative to the link coordinate system. The coordinates must be defined at the center of gravity of the link, and the coordinate axes may not be parallel to the principal axes of inertia.
- xyz (optional, defaults to zero vector) Represents the offsets in the x, y, z x,y,zx,y,z directions, in meters.
- rpy (optional: defaults to identity if not specified) Represents the rotation of the coordinate axis in the RPY direction, in radians.
- `<mass>` Mass properties of the link
- `<inertia>` 3×3 rotational inertia matrix, consisting of six independent quantities: ixx, ixy, ixz, iyy, iyz, izz.
- `<visual>` (optional)
- Visual properties of the link. Used to specify the shape of the link display (rectangle, cylinder, etc.). The same link can have multiple visual elements, and the shape of the link is formed by two of the multiple elements. In general, if the model is more complex, it can be drawn by soildwork and then generate stl calls. Simple shapes such as adding end effectors can be written directly. At the same time, the position of the geometric shape can be adjusted here according to the gap between the theoretical model and the actual model.
- `<namel>` (optional) The name of the connecting rod geometry.
- `<origin>` (optional, defaults to identity if not specified)

- The coordinate system of the geometric shape relative to the coordinate system of the connecting rod.
- xyz (optional: defaults to zero vector) Indicates the offset in the x, y, z x,y,zx,y,z direction, in meters.
- rpy (optional: defaults to identity if not specified) Indicates the rotation of the coordinate axis in the RPY direction, in radians.

- `<geometry>` (required)

- The shape of the visual object, which can be one of the following:
- `<box>` Rectangle, elements include length, width, and height. The origin is at the center.
- `<cylinder>` Cylinder, elements contain radius, length. Origin center.
- `<sphere>` Sphere, elements contain radius. Origin at center.
- `<mesh>` Mesh, determined by file, and scale is provided to define its boundaries. Collada .dae files are recommended, .stl files are also supported, but must be a local file.
- `<material>` (optional)
- Material of the visual component. Can be defined outside the link tag, but must be in the robot tag. When defined outside the link tag, the link name must be referenced.
- `<color>` (optional) Color, composed of red/green/blue/alpha, size range [0,1].
- `<texture>` (optional) Material properties, defined by file.
- `<collision>` (optional)
- Collision properties of the link. Collision properties are different from the visual properties of the link, and a simple collision model is often used to simplify calculations. The same link can have multiple collision attribute tags. The collision attribute representation of the link is composed of the set of geometric shapes it defines.
- `<name>` (optional) Specifies the name of the link geometry
- `<origin>` (optional, defaults to identity if not specified)
- The reference coordinate system of the collision component relative to the reference coordinate system of the link coordinate system.
- xyz (optional, defaults to zero vector) Represents the offset in the x, y, z x,y,zx,y,z direction, in meters.
- rpy (optional, defaults to identity if not specified) Represents the rotation of the coordinate axis in the RPY direction, in radians.
- `<geometry>` Same as the geometry element description above

For detailed elements and the functions of each element, please go to the official document for viewing

joint section

The joint section describes the kinematics and dynamics of the joint and specifies the safety limits of the joint.

Properties of joint:

name:

Specifies a unique name for the joint

type:

Specifies the type of joint, where type can be one of the following:

- revolute - A hinge joint that rotates along an axis with a range specified by upper and lower limits.
- continuous - A continuous hinge joint that rotates around an axis with no upper and lower limits.
- prismatic - A sliding joint that slides along an axis with a range specified by upper and lower limits.
- fixed - This is not a true joint as it cannot move. All degrees of freedom are locked. This type of joint does not require axis, calibration, dynamics, limits or safety_controller.
- floating - This joint allows motion in all 6 degrees of freedom.

- planar - This joint allows motion in a plane perpendicular to the axis.

Elements of joint

- `<origin>` (optional, defaults to identity if not specified) Transformation from parent link to child link, joint is located at the origin of child link. Modifying this parameter can adjust the position of the link, which can be used to adjust the error between the actual model and the theoretical model, but it is not recommended to modify it drastically, because this parameter affects the position of the link stl, which is easy to affect the collision detection effect.
- xyz (optional: defaults to zero vector) Represents the offset in the x, y, z x, y, z axis direction, in meters.
- rpy (optional: defaults to zero vector) Represents the angle of rotation around a fixed axis: roll around the x axis, pitch around the y axis, yaw around the z axis, expressed in radians.
- `<parent>` (required)
- The name of the parent link is a mandatory attribute.
- link The name of the parent link is the name of this link in the robot structure tree.
- `<child>` (required)
- The name of the child link is a mandatory attribute.
- link The name of the child link, which is the name of this link in the robot structure tree.
- `<axis>` (optional: defaults to (1,0,0))
- The axis of the joint in the joint coordinate system. This is the axis of rotation (revolute joint), the axis along which the prismatic joint moves, and the standard plane of the planar joint. This axis is specified in the joint coordinate system. Modifying this parameter can adjust the axis around which the joint rotates. It is often used to adjust the direction of rotation. If the model's rotation direction is opposite to the actual direction, just multiply by -1. Fixed and floating joints do not need this element.
- xyz (required) The x, y, z components of the axial vector, as a normalized vector.
- `<calibration>` (optional)
- The reference point of the joint, used to calibrate the absolute position of the joint.
- rising (optional) The reference point triggers a rising edge when the joint moves in the positive direction.
- falling (optional)

The reference point triggers a falling edge when the joint moves in the forward direction.

- `<dynamics>` (optional)
- This element is used to specify the physical properties of the joint. Its value is used to describe the modeling properties of the joint, especially during simulation.

`<limit>` (required when the joint is a revolute or translation joint)

- This element is the kinematic constraint of the joint.
- lower (optional, defaults to 0)

Attribute that specifies the lower limit of the joint's range of motion (in radians for revolute joints and meters for prismatic joints). This attribute is ignored for continuous joints.

- upper (optional, defaults to 0)

Attribute that specifies the upper limit of the joint's range of motion (in radians for revolute joints and meters for prismatic joints). This attribute is ignored for continuous joints.

- effort (required)

Attribute that specifies the maximum force with which the joint is applied.

- velocity (required)

Attribute that specifies the maximum velocity with which the joint is applied.

`<mimic>` (optional)

- This tag is used to specify a defined joint to mimic an existing joint. The value of this joint can be calculated using the following formula:

```
value = multiplier * other_joint_value + offset
```

- joint(required) The name of the joint to be mimicked.
- multiplier(optional) Specifies the multiplier factor in the above formula.
- offset(optional) Specifies the offset term in the above formula. The default value is 0

`<safety_controller>` (optional)

- This element is a safety control limit. The data under this element will be read into move_group, but it is actually invalid. move_group will skip this limit and directly read the parameter content under limit. At the same time, setting this element may cause planning failure.
- soft_lower_limit (optional, default is 0) This attribute specifies the lower limit of the joint safety control boundary, which is the starting limit of the joint safety control. This value needs to be greater than the lower value in the limit above.
- soft_upper_limit (optional, default is 0) This attribute specifies the upper limit of the joint safety control boundary, which is the starting limit of the joint safety control. This value needs to be less than the upper value in the limit above.
- k_position (optional, default is 0) This attribute is used to describe the relationship between position and velocity.
- k_velocity (required) This attribute is used to describe the relationship between force and velocity.

For detailed elements and their functions, please visit http://wiki.ros.org/urdf/XML/joint for more information.

A brief introduction and use of rviz

rviz is a 3D visualization platform in ROS. On the one hand, it can realize the graphical display of external information. On the other hand, it can also release control information to objects through rviz, thereby realizing the monitoring and control of robots.

Introduction to the installation and interface of rviz

When installing ros, if you perform a complete installation, rviz has been installed, and you can try to run it directly; if it is not fully installed, you can install rviz separately:

```
# Ubuntu16.04
sudo apt-get install ros-kinetic-rviz
```

```
# Ubuntu18.04
sudo apt-get install ros-melodic-rviz
```

```
# Ubuntu20.04
sudo apt-get install ros-noetic-rviz
```

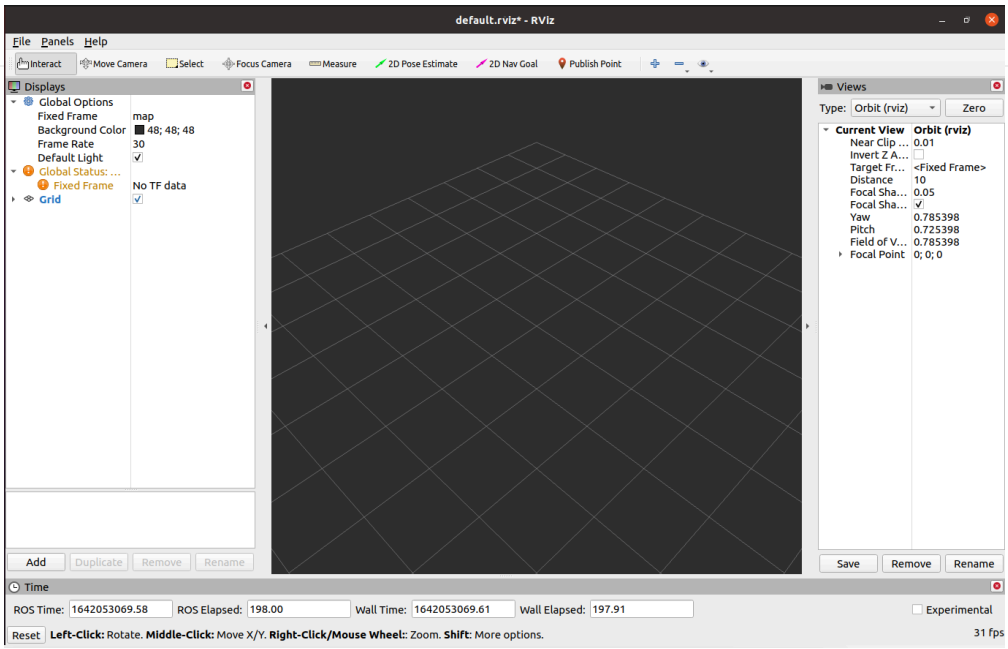
After the installation is complete, please open a new terminal (shortcut key `Ctrl`+`Alt`+`T`) and enter the following command:

```
roscore
```

Then open a new terminal (shortcut key `Ctrl`+`Alt`+`T`) and enter the command to open rviz

```
rosrun rviz rviz
# or
rviz
```

Open rviz and the following interface will be displayed:



Introduction to each area

- On the left is the display list. A display is something that draws something in the 3D world and may have some options available in the display list.
- On the top is the toolbar, which allows users to select multiple functions with various function keys
- In the middle is the 3D view: it is the main screen that allows users to view various data in three dimensions. The background color, fixed frame, grid, etc. of the 3D view can be set in detail in the Global Options and Grid items displayed on the left.
- Below is the time display area, including system time and ROS time.
- On the right is the observation angle setting area, which can set different observation angles.

In this section, we will only give a rough introduction. If you want to know more details, you can go to the User Guide to check it out.

mycobot_ros installation and update

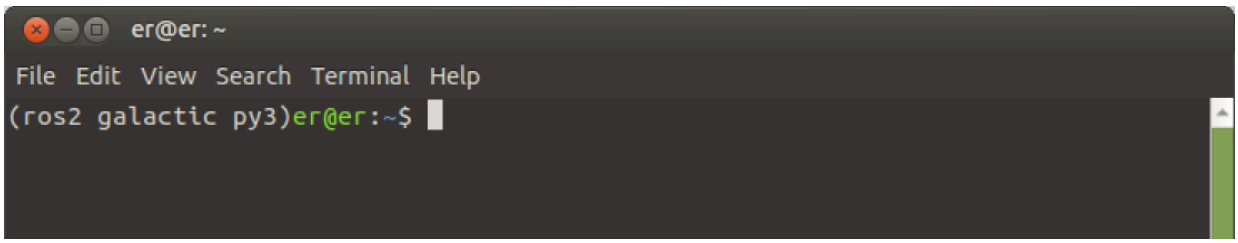
- **PI version (Ubuntu 20.04):**

`mycobot_ros` is a ROS package launched by ElephantRobotics that is compatible with various types of desktop robotic arms.

Project address: https://github.com/elephantrobotics/mycobot_ros

The official default workspace is `catkin_ws` .

Click the `ROS1 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS1 environment terminal:



Then enter the following command:

```
cd ~/catkin_ws/src # Enter the src folder in the workspace
# Clone the code on github
git clone https://github.com/elephantrobotics/mycobot_ros.git
cd .. # Return to the workspace
catkin_make # Build the code in the workspace
source devel/setup.bash # Add environment variables
```

Note: If the `mycobot_ros` folder already exists in the `/home/er/catkin_ws/src (equivalent to ~/catkin_ws/src)` directory, you need to delete the original `mycobot_ros` first, and then execute the above command. Among them, `er` in the directory path is the user name of the virtual machine. If it is inconsistent, please modify it.

Simple use

Start through the launch file

This example is based on the premise that you have completed Environment Construction and successfully copied the company's code from GitHub.

Open a console terminal (shortcut key `Ctrl+Alt+T`) Enter the following command to **ROS environment configuration**.

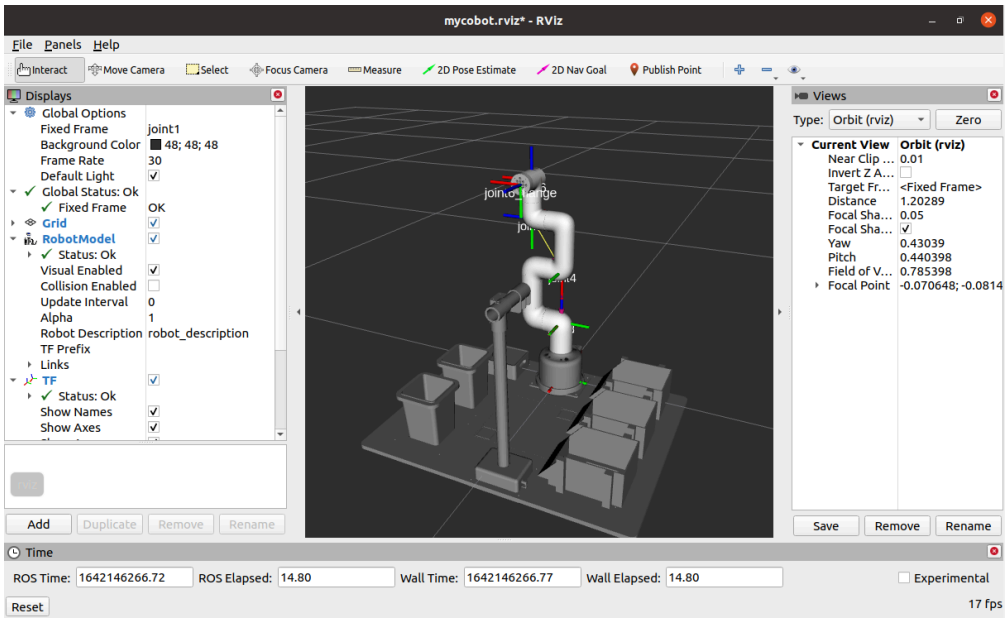
```
cd ~/catkin_ws/
source devel/setup.bash
```

Enter again:

- mycobot 280-Pi version:

```
roslaunch mycobot_280pi test.launch
```

Open rviz and get the following result:



If you want to learn more about rviz, you can go to the official document to view it

280 series rviz user guide

Robot arm control

> **Note:** For better motion effects, the Atom firmware version of the end arm is 6.5, and the python driver library pymycobot version is 3.5.3

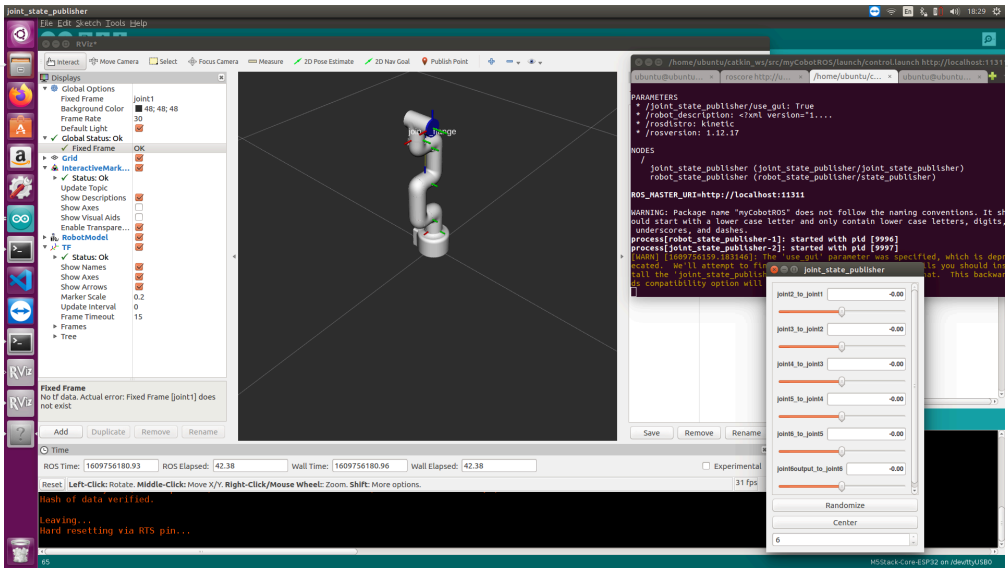
1 Slider control

Open a command line and run:

- mycobot 280-Pi version:

```
# The default serial port name of mycobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.

roslaunch mycobot_280pi slider_control.launch port:=/dev/ttyAMA0 baud:=1000000
```

It will **open rviz and a slider component**, you will see the following screen:



Then you can **control the movement of the model in rviz by dragging the slider**. If you want the real mycobot to move with you, you need to open another command line and run:

- mycobot 280-Pi version:

```
# The default serial port name of mycobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
rosrun mycobot_280pi slider_control.py _port:=/dev/ttyAMA0 _baud:=1000000
```

Please note: due to the commandThe robot arm will move to the current position of the model while inputting. Before you use the command, please make sure that the model in rviz does not have any penetration Do not drag the slider quickly after connecting the robot arm to prevent damage to the robot arm

2 Model following

In addition to the above controls, we can also **let the model follow the real robot arm movement**. Open a command line and run:

- mycobot 280-pi version:

```
# The default serial port name of mycobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
rosrun mycobot_280pi follow_display.py _port:=/dev/ttyAMA0 _baud:=1000000
```

Then open another command line and run:

- mycobot 280-Pi version:

  ```
  roslaunch mycobot_280pi mycobot_follow.launch
  ```

  It will **open rviz to show the model following effect**.

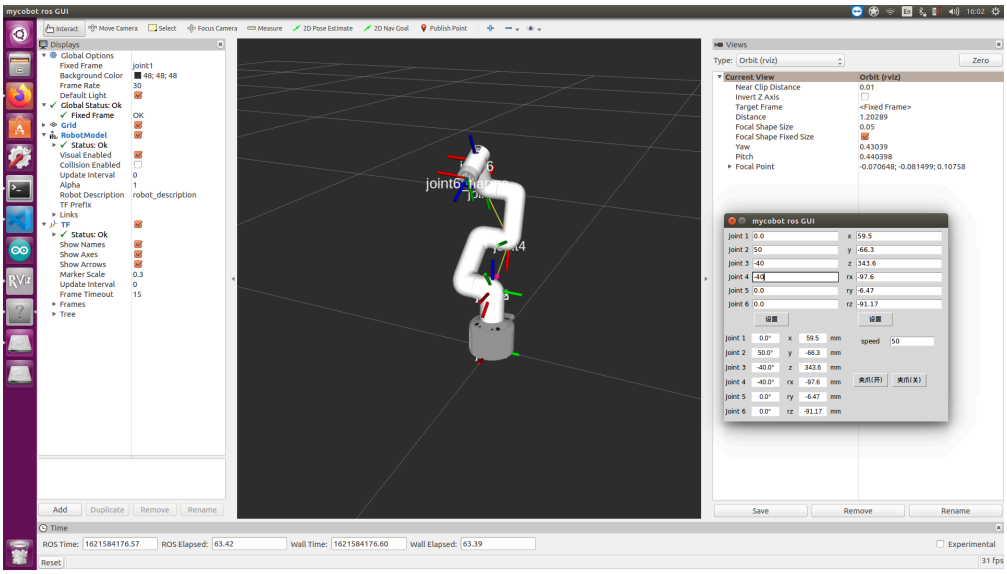
3 GUI control

Based on the previous, this package also **provides a simple Gui control interface**. This method is intended for real robotic arms to interact with each other, please connect mycobot.

Open the command line:

- mycobot 280-Pi version:

```
# The default serial port name of mycobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
roslaunch mycobot_280pi simple_gui.launch port:=/dev/ttyAMA0 baud:=1000000
```



4 Keyboard control

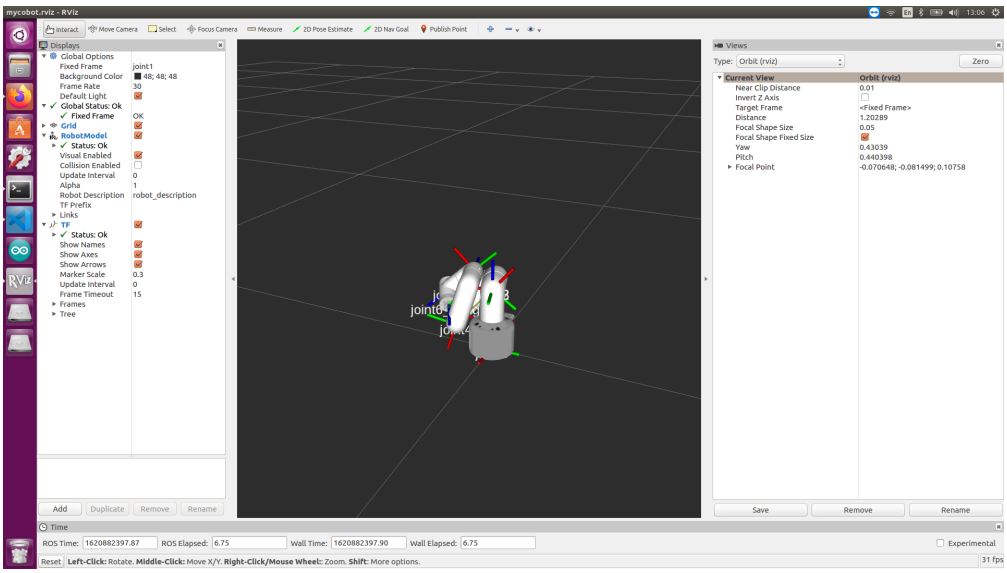
Added the keyboard control function in the `mycobot_280` package, and synchronized it in real time in rviz. This function depends on pythonApi, so make sure it is connected to the real robot arm.

Open a command line and run:

- mycobot 280-Pi version:

```
# The default serial port name of mycobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
roslaunch mycobot_280pi teleop_keyboard.launch port:=/dev/ttyAMA0 baud:=1000000
```

The running effect is as follows:



The command line will output mycobot information as follows:

```
SUMMARY
========

PARAMETERS
    * /mycobot_services/baud: 1000000
    * /mycobot_services/port: /dev/ttyAMA0
    * /robot_description: <?xml version="1....
    * /rosdistro: noetic
    * /rosversion: 1.16.0

NODES
  /
    mycobot_services (mycobot_communication/mycobot_topics.py)
    real_listener (mycobot_280/listen_real_of_topic.py)
    robot_state_publisher (robot_state_publisher/robot_state_publisher)
    rviz (rviz/rviz)

auto-starting new master
process[master]: started with pid [217714]
ROS_MASTER_URI=http://localhost:11311

setting /run_id to 01e863c8-5642-11f0-a2da-335dad9016e7
process[rosout-1]: started with pid [217728]
started core service [/rosout]
process[robot_state_publisher-2]: started with pid [217731]
process[rviz-3]: started with pid [217733]
process[mycobot_services-4]: started with pid [217738]
process[real_listener-5]: started with pid [217740]
current pymycobot library version: 3.9.9
pymycobot library version meets the requirements!
ls: cannot access '/dev/ttyUSB*': No such file or directory
[INFO] [1751350196.024298]: /dev/ttyAMA0,1000000

MyCobot Status
---------------------------------
Joint Limit:
    joint 1: -168 ~ +168
    joint 2: -135 ~ +135
    joint 3: -150 ~ +150
    joint 4: -145 ~ +145
    joint 5: -165 ~ +165
    joint 6: -180 ~ +180

Connect Status: True

Servo Infomation: all connected

Servo Temperature: unknown
```

```
Atom Version: 7.2
```

Next, open another command line and run:

- mycobot 280-Pi version:

```
rosrun mycobot_280pi teleop_keyboard.py
#or
rosrun mycobot_280pi teleop_keyboard.py _speed:=70
```

You will see the following output in the command line:

```
[INFO] [1751342043.889285]: Waiting to receive current coordinates...
Mycobot Teleop Keyboard Controller (ROS1 - Topic Version)
---------------------------------------------------------
Movement (Cartesian):
              w (x+)
    a (y-)    s (x-)    d (y+)
              z (z-)    x (z+)

Rotation (Euler angles):
    u (rx+)  i (ry+)  o (rz+)
    j (rx-)  k (ry-)  l (rz-)

Movement Step:
    + : Increase movement step size
    - : Decrease movement step size

Gripper:
    g - open    h - close

Pump:
    b - open    m - close

Other:
    1 - Go to init pose
    2 - Go to home pose
    3 - Save current pose as home
    q - Quit

currently:    speed: 50    change percent: 5
[INFO] [1751342044.199244]: Current moving step: position 12.5 mm, angle attitude 9.0°
```

In this terminal, you can control the state of the robot and move the robot through the keys in the command line.

Parameters supported by this script:

- _speed: robot movement speed.

- _change_percent: movement distance percentage.

5 End effector

- **Supported end effectors:** myCobot Adaptive Gripper, myCobot Vertical Suction Pump V2.0, Camera Flange
- **Applicable devices:** myCobot 280 M5, myCobot 280 PI

> Note: myCobot Adaptive Gripper only supports myCobot 280 M5 devices

5.1 myCobot vertical pump V2.0

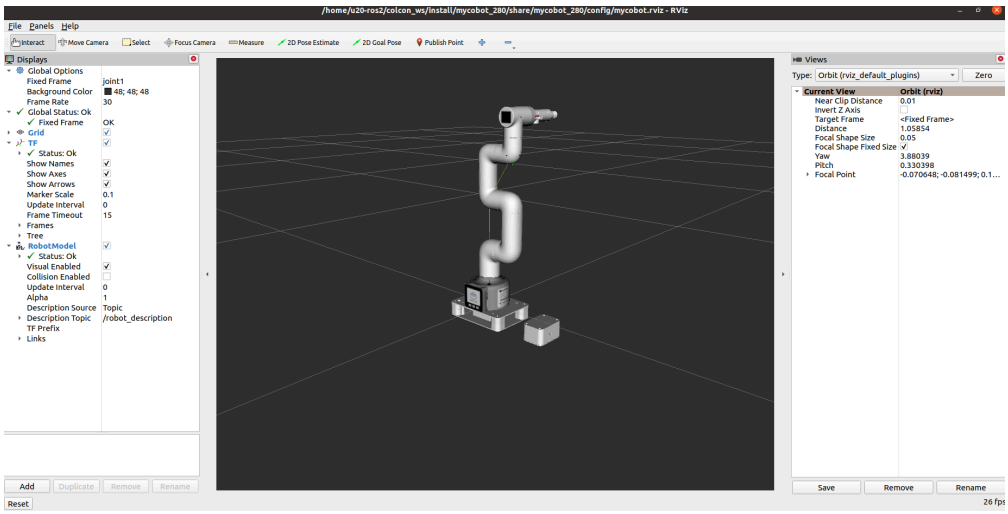
1 Load the model

Open a command line and run:

- myCobot 280-PI version:

```
roslaunch mycobot_280pi test_pump.launch
```

It will **open rviz** and you will see the following screen:



2 Slider control

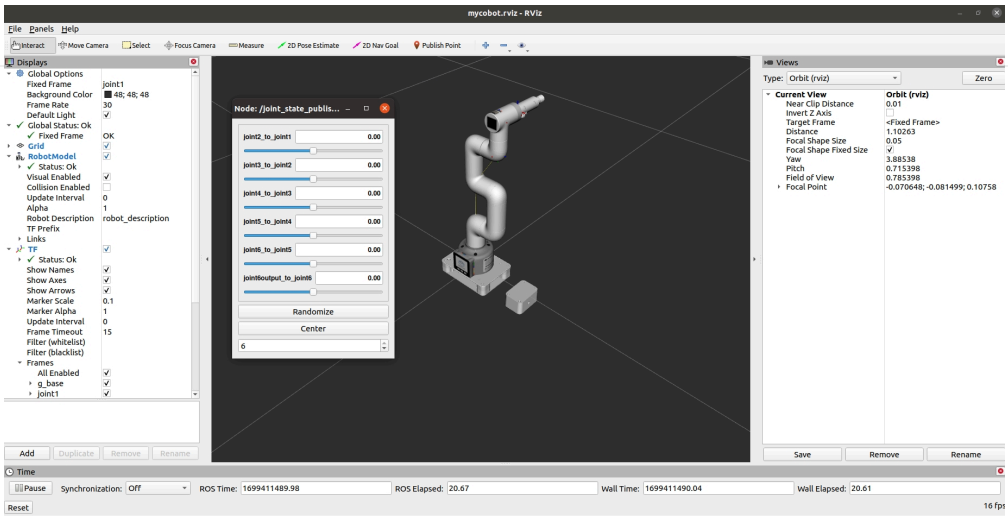
> **Note: This function only supports the control of the robot**

Open a command line and run:

- myCobot 280-PI version:

```
### The default serial port name of myCobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
roslaunch mycobot_280pi slider_control_pump.launch port:=/dev/ttyAMA0 baud:=1000000
```

It will **open rviz and a slider component**, and you will see the following screen:



Then you can **control the movement of the model in rviz by dragging the slider.** If you want the real myCobot to move with you, you need to **open another command line** and run:

- myCobot 280-PI version:

```
### The default serial port name of myCobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
rosrun mycobot_280pi slider_control.py _port:=/dev/ttyAMA0 _baud:=1000000
```

Please note: Since the robot will move to the current position of the model when the command is input, please make sure that the model in rviz does not have any penetration before you use the command. Do not drag the slider quickly after connecting the robot to prevent damage to the robot.

5.2 Camera Flange

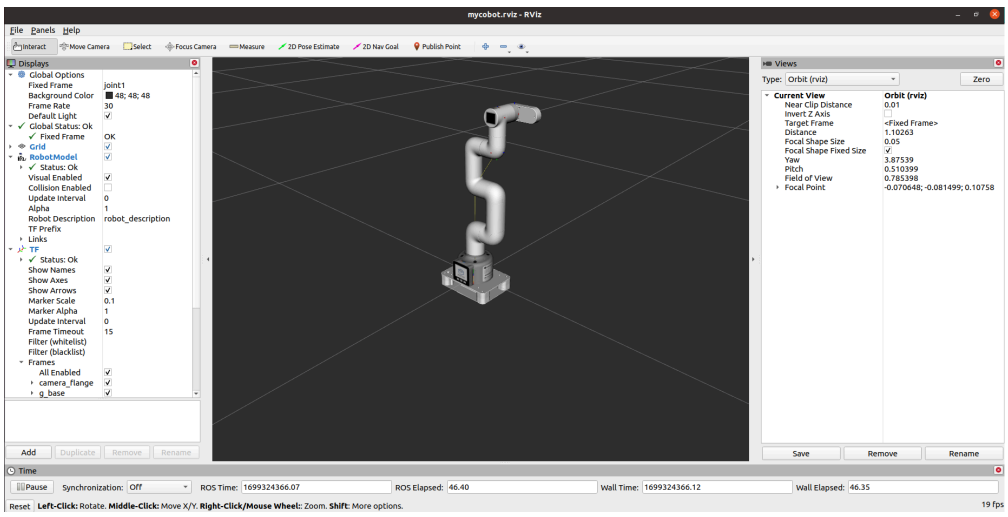
1 Load the model

Open a command line and run:

- myCobot 280-PI version:

```
roslaunch mycobot_280pi test_camera_flange.launch
```

It will **open rviz** and you will see the following screen:



2 Slider Control

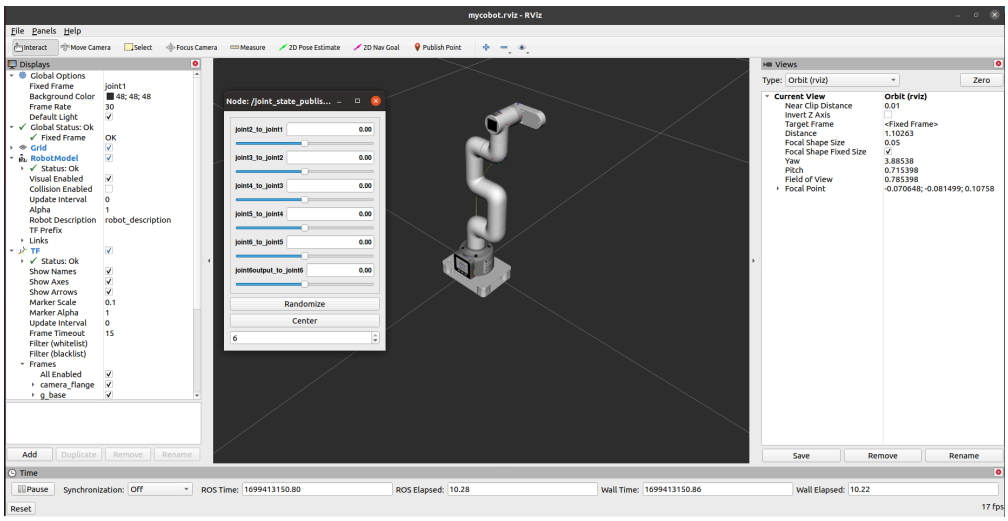
> **Note: This function only supports the control of the robot**

Open a command line and run:

- myCobot 280-PI version:

```
# The default serial port name of myCobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
roslaunch mycobot_280pi slider_control_camera_flange.launch port:=/dev/ttyAMA0 baud:=1000000
```

It will **open rviz and a slider component**, and you will see the following screen:



Then you can **control the movement of the model in rviz by dragging the slider.** If you want the real myCobot to move with you, you need to **open another command line** and run:

- myCobot 280-PI version:

```
# The default serial port name of myCobot 280-Pi version is "/dev/ttyAMA0" and the baud rate is 1000000.
rosrun mycobot_280pi slider_control.py _port:=/dev/ttyAMA0 _baud:=1000000
```

Please note: Since the robot will move to the current position of the model when the command is input, please make sure that the model in rviz does not have any penetration before you use the command. **Do not drag the slider quickly after connecting the robot to prevent damage to the robot**.

5.3 Camera Flange && Pump

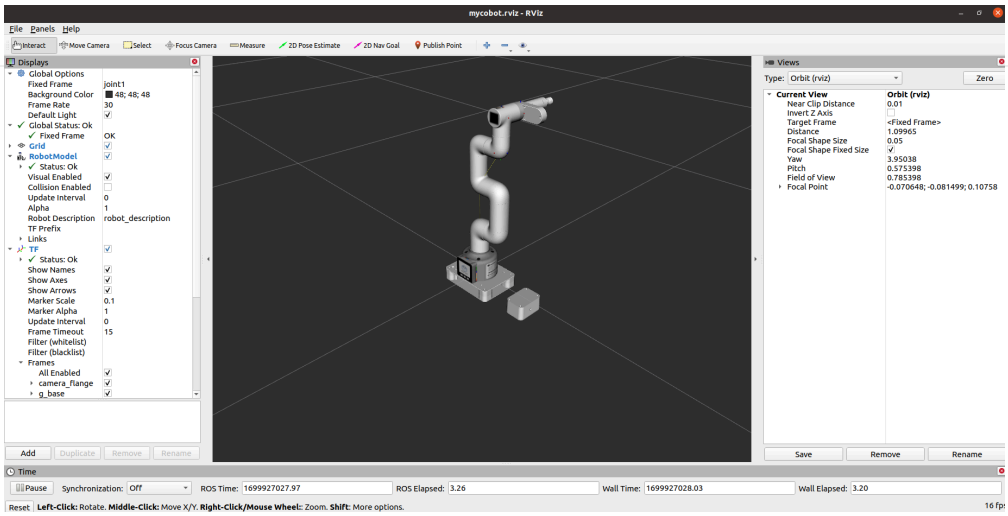
1 Load the model

Open a command line and run:

- myCobot 280-PI version:

```
roslaunch mycobot_280pi test_camera_flange_pump.launch
```

It will **open rviz** and you will see the following:



5.4 URDF model address

1 myCobot vertical suction pump V2.0

- myCobot 280-PI version

2 Camera flange

- myCobot 280-PI version

3 Camera flange && suction pump

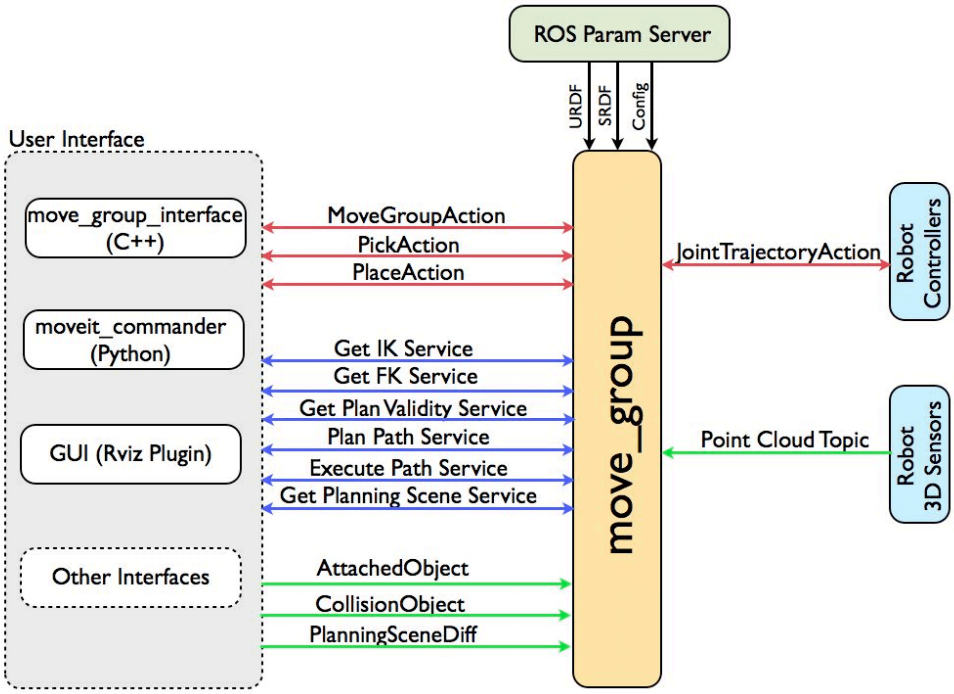
myCobot 280-PI version

MoveIt

Introduction to MoveIt

MoveIt is an integrated development platform in ROS, consisting of a variety of function packages for manipulating robotic arms, including: motion planning, manipulation, control, inverse kinematics, 3D perception, and collision detection.

The figure below shows the high-level structure of the main node **move_group** provided by Moveit. It is like a combiner: it integrates all individual components together and provides a series of actions and services for users to use.



User Interface

Users can access the operations and services provided by move_group in three ways:

- In C++: Use the move_group_interface package to facilitate the practical use of move_group.
- In Python: Use the moveit_commander package.
- Via GUI: Use Rviz (ROS Visualizer) from Motion-commander.

move_group can be configured using the ROS parameter server, from which it can also get the robot's URDF and SRDF.

Configuration

move_group is a ROS node. It uses the ROS parameter server to get three kinds of information:

1. URDF - move_group looks up the robot_description parameter on the ROS parameter server to get the robot's URDF.
2. SRDF - move_group looks up the robot_description_semantic parameter on the ROS parameter server to get the robot's SRDF. The SRDF is usually created by the user using the MoveIt Setup Assistant.

3. MoveIt Configuration - move_group will look up additional configuration specific to MoveIt on the ROS parameter server, including joint limits, kinematics, motion planning, perception, and other information. Configuration files for these components are automatically generated by the MoveIt setup assistant and stored in the configuration directory of the corresponding MoveIt configuration package for the robot.

How to use MoveIt

> **Note:** For better motion effects, the Atom firmware version of the end arm is 6.5, and the python driver library pymycobot version is 3.5.3

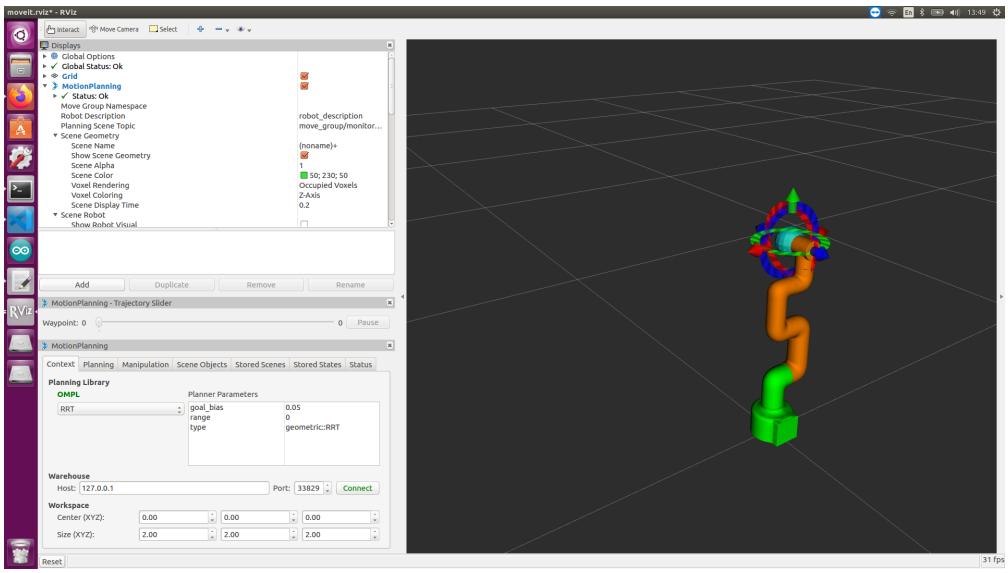
`mycobot_ros` now has MoveIt integrated.

Open the command line and run:

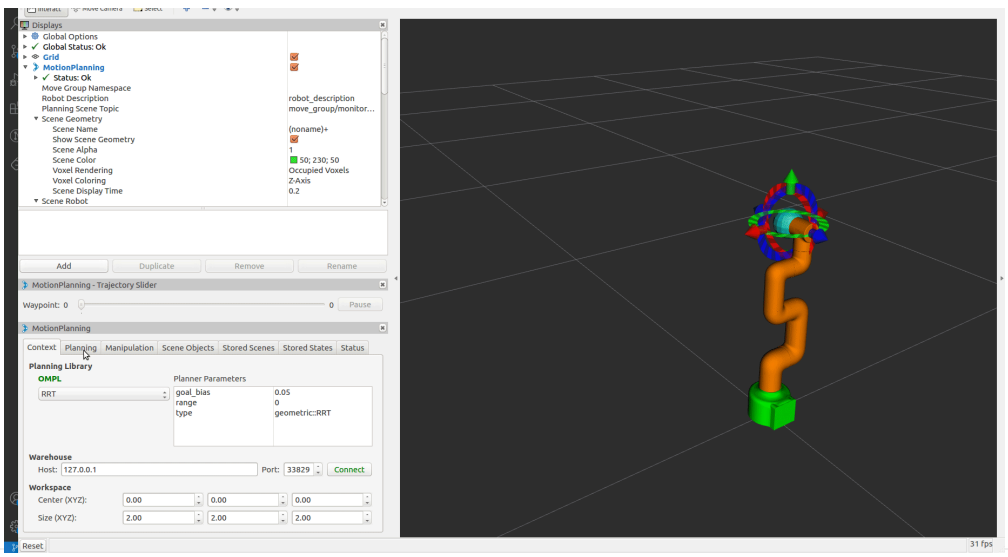
- mycobot 280-Pi version:

```
roslaunch mycobot_280pi_moveit mycobot_moveit.launch
```

The running effect is as follows:



You can plan and execute, demonstration effect:



If you need to let the real robot arm execute the plan synchronously, you need to open another command line and run:

- mycobot 280-M5 version:

```
# The default serial port name of mycobot 280-M5 version is "/dev/ttyUSB0", and the baud rate is 115200. The serial port n
rosrun mycobot_280_moveit sync_plan.py _port:=/dev/ttyUSB0 _baud:=115200
```

- mycobot 280-Pi version:

```
# The default serial port name of mycobot 280-Pi version is "/dev/ttyAMA0", and the baud rate is 1000000.
rosrun mycobot_280pi_moveit sync_plan.py _port:=/dev/ttyAMA0 _baud:=1000000
```

- mycobot 280-JetsonNano version:

```
# mycobot The default serial port name of 280-JetsonNano version is "/dev/ttyTHS1" and the baud rate is 1000000.
rosrun mycobot_280jn_moveit sync_plan.py _port:=/dev/ttyTHS1 _baud:=1000000
```

- mycobot 280-Arduino version:

```
# The default serial port name of mycobot 280-Arduino version is "/dev/ttyACM0" and the baud rate is 115200.
rosrun mycobot_280arduino_moveit sync_play.py _port:=/dev/ttyACM0 _baud:=115200
```

Introduction to ROS2

ROS2's predecessor is ROS, which stands for Robot Operating System. However, ROS itself is not an operating system, but a software library and tool set. The emergence of ROS solved the communication problem of various robot components. Later, more and more robot algorithms were integrated into ROS. ROS2 inherited ROS and is more powerful and easier to use than ROS.

Design goals and features of ROS2

ROS2 shoulders the historical mission of changing the era of intelligent robots. At the beginning of the design, it was considered to meet the needs of various robot applications.

- **Multi-robot system:** In the future, robots are no longer independent individuals, and robots also need to communicate and collaborate. ROS2 provides standard methods and communication mechanisms for the application of multi-robot systems.
- **Cross-platform:** The control platforms used will be very different in different robot application scenarios. In order to enable all robots to run ROS2, ROS2 can run cross-platform on Linux, Windows, MacOS, and RTOS.
- **Real-time:** Robot motion control and many behavioral strategies require robots to be real-time. For example, a robot must reliably detect pedestrians in front of it within 100 milliseconds, or complete kinematic and dynamic calculations within 1 millisecond. ROS2 provides basic requirements in real time like this.
- **Productization:** A large number of robots have entered our lives, and there will be more and more in the future. ROS2 can not only be used in the robot R&D stage, but can also be directly installed in products and enter the consumer market. This also poses a huge challenge to the stability and robustness of ROS2.
- **Project management:** Robot development is a complex system engineering. Project management tools and mechanisms for the entire process of design, development, debugging, testing, and deployment will also be reflected in ROS2, making it easier for us to develop robots.

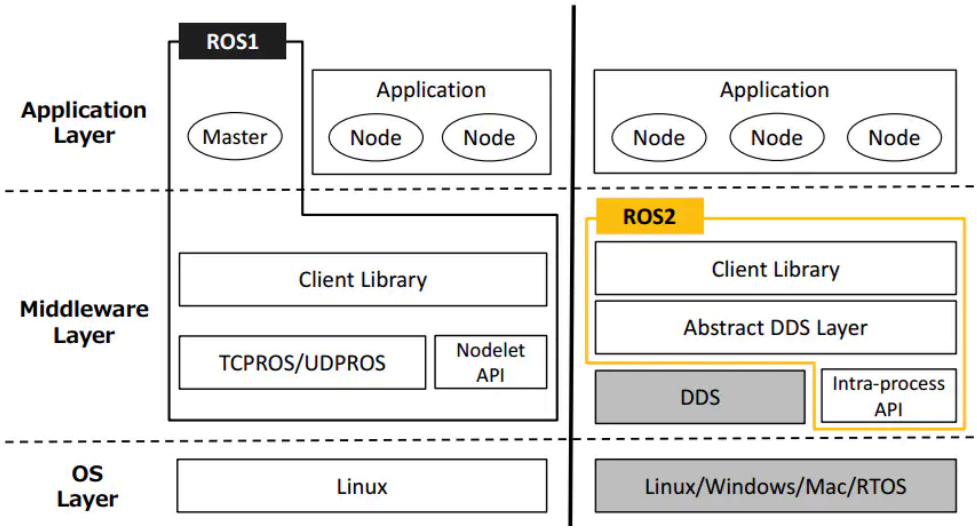
Release version

The corresponding release version and maintenance cycle of ROS2 and Ubuntu.

ROS2 version	Release date	Maintenance period	Ubuntu version
Dashing	2019.5	2021.5	Ubuntu 18.04 (Bionic Beaver)
Eloquent	2019.11	2020.11	Ubuntu 18.04 (Bionic Beaver)
Foxy	2020.6	2023.5	Ubuntu 20.04(Focal Fossa)
Galactic	2021.5	2022.11	Ubuntu 20.04(Focal Fossa)
Humble	2022.5	2027.5	Ubuntu 22.04(Jammy Jellyfish)

Comparison between ROS and ROS2

ROS2 redesigned the system architecture. The architectural changes between the two generations of ROS are as follows:



- **OS Layer:** OS layer. In ROS2, it can be built on Linux or other systems, even bare metal without an operating system.
- **Middleware Layer:** Middleware layer. The communication system of ROS1 is based on TCPROS/UDPROS, while the communication system of ROS2 is based on DDS. DDS is a standard solution for data publishing/subscription in distributed real-time systems.
- **Application Layer:** Application layer. ROS1 relies on ROS Master, while in ROS2, a discovery mechanism called "Discovery" is used between nodes to help each other establish connections.

ROS has designed a complete set of communication mechanisms (topics, services, parameters, actions) to simplify robot development. Through this mechanism, the various components of the robot can be connected. This mechanism designs a node called Ros Master, and the communication of all other components must go through the master node. Once the master node hangs up, it will cause the communication of the entire robot system to collapse! Therefore, the instability of Ros cannot be used to make some high-risk robots such as autonomous driving. In addition, there are the following disadvantages:

- TCP-based communication has poor real-time performance and high system overhead
- Not friendly to python3 support
- Incompatible message mechanism
- No encryption mechanism, low security

ROS2 first removes the master node in ROS. After removing the master node, each node can discover each other through the DDS node. Each node is equal and can achieve one-to-one, one-to-many, and many-to-many communication. After using DDS for communication, reliability and stability are enhanced.

Compared with **ROS** that only supports Linux systems, **ROS2** also supports Windows, Mac and even RTOS platforms.

ROS2 Development Guide

ROS2 Installation Guide

ROS2 Basic Use

rivz Use Guide

ROS2 environment installation

Raspberry Pi version:

The Raspberry Pi version comes with Ubuntu (V-20.04) system and built-in development environment. No need to build and manage, just update the `mycobot_ros2` package.

`mycobot_ros2` is the ROS2 package launched by Elephant Robotics for its mycobot series of desktop six-axis robotic arms.

ROS2 project address: http://github.com/elephantrobotics/mycobot_ros2

Robot API driver library address: https://github.com/elephantrobotics/pymycobot

Update mycobot_ros2 package

To ensure that users can use the latest official package in a timely manner, you can enter the `/home/er/colcon_ws/src` folder through the file manager, open the console terminal (shortcut `Ctrl+Alt+T`), and enter the following command to update:

```
# Clone the code on github
cd colcon_ws/src # Enter the src folder in the workspace
# Clone the code on github
git clone --depth 1 https://github.com/elephantrobotics/mycobot_ros2.git
cd .. # Return to the workspace
colcon build --symlink-install # Build the code in the workspace, --symlink-install: avoid recompiling every time you adju
source install/setup.bash # Add environment variables
```

Note: If the `mycobot_ros2` folder already exists in the `/home/er/colcon_ws/src (equivalent to ~/colcon_ws/src)` directory, you need to delete the original `mycobot_ros2` first, and then execute the above command. Among them, `er` in the directory path is the system user name. If there is any inconsistency, please modify it.

At this point, the ROS2 environment is built. For the use of ROS2, please refer to the Rviz introduction and use section.

Basic Tools

In this chapter, you will learn about the common command tools of ROS2.

Topics

ROS 2 breaks down complex systems into many modular nodes. Topics are an important element of the ROS graph, acting as a bus for nodes to exchange messages. Topics are one of the main ways data moves between nodes, and therefore between different parts of the system.

Specific reference: Official tutorial

- **topics help**

```
ros2 topics -h
```

- **Start turtlesim and keyboard control**

```
ros2 run turtlesim turtlesim_node
ros2 run turtlesim turtle_teleop_key
```

- **Node relationship graph**

```
rqt_graph
```

- **Understand topics related commands**

```
ros2 topics -h
```

- **Topic list**

```
ros2 topic list
ros2 topic list -t # Display the corresponding message type
```

- **View topic content**

```
ros2 topic echo <topic_name>
ros2 topic echo /turtle1/cmd_vel
```

- **Display topic related information, type**

```
ros2 topic info <topic_name>
# Output /turtle1/cmd_vel topic interface related information
ros2 topic info /turtle1/cmd_vel
```

- **Display interface related information**

```
ros2 interface show <msg_type>
# Output geometry_msgs/msg/Twist interface related information
ros2 interface show geometry_msgs/msg/Twist
```

- **Publish command**

```
ros2 topic pub <topic_name> <msg_type> '<args>'
# Publish speed command
ros2 topic pub --once /turtle1/cmd_vel geometry_msgs/msg/Twist "{linear: {x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0, y: 0.
# Publish speed commands at a certain frequency
ros2 topic pub --rate 1 /turtle1/cmd_vel geometry_msgs/msg/Twist "{linear: {x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0, y:
```

- **View the frequency of topic publishing**

```
ros2 topic hz <topic_name>
#Output/turtle1/cmd_vel publishing frequency
ros2 topic pub --rate 1 /turtle1/cmd_vel geometry_msgs/msg/Twist "{linear: {x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0, y:
```

Nodes

Each node in ROS should be responsible for a single module purpose (e.g., one node for controlling wheel motors, one node for controlling laser rangefinders, etc.). Each node can send and receive data to other nodes through topics, services, actions, or parameters. A complete robotic system consists of many nodes working together. In ROS 2, a single executable file (C++ program, Python program, etc.) can contain one or more nodes.

Specific reference: Official tutorial

- **nodes help**

```
ros2 nodes -h
```

- **Start turtlesim and keyboard control**

```
ros2 run turtlesim turtlesim_node
ros2 run turtlesim turtle_teleop_key
```

- **View the node list**

```
ros2 node list
```

- **View the node relationship graph**

```
rqt_graph
```

- **Remap**

```
ros2 run turtlesim turtlesim_node --ros-args --remap __node:=my_turtle
ros2 node list
```

- **View node information**

```
ros2 node info <node_name>
ros2 node info /my_turtle
```

Services

Services are another way for nodes in the ROS graph to communicate. Services are based on a call and response model, rather than the publisher-subscriber model of topics. While topics allow nodes to subscribe to a stream of data and get continuous updates, services only provide data when specifically called by a client.

Specific reference: Official tutorial

- **services help**

```
ros2 service -h
```

- **Start turtlesim and keyboard control**

```
ros2 run turtlesim turtlesim_node
ros2 run turtlesim turtle_teleop_key
```

- **View the service list**

```
ros2 service list
# Display service list and message type
ros2 service list -t
```

- **View the message type received by the service**

```
ros2 service type <service_name>
ros2 service type /clear
```

- **Find services that use a certain message type**

```
ros2 service find <type_name>
ros2 service find std_srvs/srv/Empty
```

- **View service message type definition**

```
ros2 interface show <type_name>.srv
ros2 interface show std_srvs/srv/Empty.srv
```

- **Call service command, clear walking track**

```
ros2 service call <service_name> <service_type>
ros2 service call /clear std_srvs/srv/Empty
```

- **Generate a new turtle**

```
ros2 service call /spawn turtlesim/srv/Spawn "{x: 2, y: 2, theta: 0.2, name: 'turtle2'}"
```

Parameters

Parameters are configuration values for a node. You can think of parameters as node settings. Nodes can store parameters as integers, floating point numbers, Boolean values, strings, and lists. In ROS 2, each node maintains its own parameters. For more background on parameters, see the concepts documentation.

Specific reference: Official tutorial

- **parameters help**

```
ros2 param -h
```

- **Start turtlesim and keyboard control**

```
ros2 run turtlesim turtlesim_node
ros2 run turtlesim turtle_teleop_key
```

- **View service list**

```
ros2 param list
```

- **Get parameter value**

```
ros2 param get <node_name> <parameter_name>
ros2 param get /turtlesim background_g
```

- **Set parameter value**

```
ros2 param set <node_name> <parameter_name> <value>
ros2 param set /turtlesim background_r 150
```

- **Export parameter values**

```
ros2 param dump <node_name>
ros2 param dump /turtlesim
```

- **Import parameters independently**

```
ros2 param load <node_name> <parameter_file>
ros2 param load /turtlesim ./turtlesim.yaml
```

- **Start node and import parameters**

```
ros2 run <package_name> <executable_name> --ros-args --params-file <file_name>
ros2 run turtlesim turtlesim_node --ros-args --params-file ./turtlesim.yaml
```

Actions

Actions are a type of communication in ROS 2 used for long-running tasks. They consist of three parts: a goal, a response, and a result.

Actions are based on topics and services. They function like services, except that actions are preemptible (you can cancel them while they are executing). They also provide steady feedback, rather than services that return a single response.

Actions use a client-server model, similar to the publisher-subscriber model (described in the topic tutorial). An "action client" node sends a target to an "action server" node, which confirms the target and returns a stream of feedback and results.

Specific reference: Official tutorial

- **action help**

```
ros2 action -h
```

- **Start turtlesim and keyboard control**

```
ros2 run turtlesim turtlesim_node
ros2 run turtlesim turtle_teleop_key
```

Press G|B|V|C|D|E|R|T to rotate, press F to cancel

- **View the server and client of the node action**

```
ros2 node info /turtlesim
```

- **View the action list**

```
ros2 action list
ros2 action list -t # DisplayAction type
```

- **View action information**

```
ros2 action info <action>
ros2 action info /turtle1/rotate_absolute
```

- **View action message content**

```
ros2 interface show turtlesim/action/RotateAbsolute
```

- **Send action target information**

```
ros2 action send_goal <action_name> <action_type>
ros2 action send_goal /turtle1/rotate_absolute turtlesim/action/RotateAbsolute "{theta: 1.57}"
# With feedback information
ros2 action send_goal /turtle1/rotate_absolute turtlesim/action/RotateAbsolute "{theta: 0}" --feedback
```

RQt

RQt is a graphical user interface framework that implements various tools and interfaces in the form of plugins. You can run all your existing GUI tools as dockable windows in RQt! The tools can still be run in the traditional standalone way, but RQt makes it easier to manage all the different windows in a single screen layout.

Specific reference: Official Tutorial

You can easily run any RQt tool/plugin by:

```
rqt
```

- **rqt help**

```
rqt -h
```

- **Start turtlesim and keyboard control**

```
ros2 run turtlesim turtlesim_node
ros2 run turtlesim turtle_teleop_key
```

- Action browser: / Plugins -> Actions ->Action Type Browser
- Parameter reconfiguration: / Plugins -> configuration ->Parameter Reconfigure
- Node graph: /Node Graph
- Control steering: /Plugins -> Robot Tools -> Robot Steering
- Service call: /Plugins -> Services -> Service Caller
- Service type browser: Plugins -> Services -> Service Type Browser
- Message publishing: Plugins -> Topics -> Message Publisher
- Message type browser: Plugins -> Topics -> Message Type Browser
- Topic list: Plugins -> Topics -> Topic Monitor
- Draw a curve: Plugins -> Visualization -> Plot
- **View log: rqt_console**

```
ros2 run rqt_console rqt_console
ros2 run turtlesim turtlesim_node
ros2 topic pub -r 1 /turtle1/cmd_vel geometry_msgs/msg/Twist "{linear: {x: 2.0, y: 0.0, z: 0.0}, angular: {x: 0.0,y: 0.0,z
```

TF2

tf2 It is a transformation library that allows users to track multiple coordinate systems over time. tf2 maintains the relationship between coordinate systems in a time-buffered tree structure and lets users transform points, vectors, etc. between any two coordinate systems at any desired time point.

Specific reference: Official Tutorial

Let's start by installing the demo package and its dependencies.

```
sudo apt-get install ros-foxy-turtle-tf2-py ros-foxy-tf2-tools ros-foxy-tf-transformations
```

- **Follow**
- launch starts two turtles, the first turtle automatically follows the second

```
ros2 launch turtle_tf2_py turtle_tf2_demo.launch.py
```

- Control the movement of the first turtle through the keyboard

```
ros2 run turtlesim turtle_teleop_key
```

- **View TF tree**

```
ros2 run tf2_tools view_frames.py
evince frames.pdf
```

- **View the relationship between the two coordinate systems**

```
ros2 run tf2_ros tf2_echo [reference_frame] [target_frame]
ros2 run tf2_ros tf2_echo turtle2 turtle1
```

- **View TF relations on rviz**

```
ros2 run rviz2 rviz2 -d $(ros2 pkg prefix --share turtle_tf2_py)/rviz/turtle_rviz.rviz
```

URDF

URDF is the Unified Robot Description Format, which is used to specify robot geometry and organization in ROS.

Specific reference: Official tutorial

- **Full syntax**

```
<robot>
    # describe:
    # Parameters: name=""
    #  Child node:
        <link>
            # Description:
            # Parameters: name=""
            # Child node:
                <visual>
                    # describe:
                    # Parameters:
                    # child nodes:
                        <geometry>
                            # description
                            # parameters
                            # Child node:
                                <cylinder />
                                    # Description:
                                    # Parameters:
                                        # length="0.6"
                                        # radius="0.2"
                                <box />
                                    # description
                                    # Parameters:size="0.6 0.1 0.2"
                                <mesh />
                                    #  Description
                                    #Parameters: filename="package://urdf_tutorial/meshes/l_finger_tip.dae"
                        <collision>
                            # Description: collision element, prioritized
                            # parameters
                            # child node
                                <geometry>
                        <inertial>
                            # description
                            # parameters
                            # Child nodes:
                                <mass />
                                    # description: mass
                                    # Parameters: value=10
                                <inertia />
                                    # Description: Inertia
                                    # Parameters: i+"Cartesian product of xyz" (9 in total)="0.4"
                        <origin />
                            # Description:
                            # Parameters:
                                # rpy="0 1.5 0"
                                # xyz="0 0 -0.3"
                        <material />
                            # Description
                            # Parameters: name="blue"
```

```
        <joint>
            # Description
            # Parameters:
                # name=""
                # type=""
                    # fixed
                    # prismatic
            # child node
                <parent />
                    # Description
                    # Parameters: link=""
                <child />
                    # Description:
                    # Parameters: link=""
                <origin />
                    # Description:
                    # Parameters: xyz="0 -0.2 0.25"
                <limit />
                    # Description
                    # Parameters:
                        # effort="1000.0"    maximum effort
                        # lower="-0.38"      Joint upper limit (radians)
                        # upper="0"          Joint lower limit (radians)
                        # velocity="0.5"     Maximum velocity
                <axis />
                    # Description:  Press ? axis rotation
                    # Parameters: xyz="0 0 1", along the Z axis
        <material>
            # Description:
            # Parameters: name="blue"
            # child node:
                <color />
                    # description:
                    # Parameters: rgba="0 0 0.8 1"
```

- **Download source code**

```
cd ~/dev_ws
git clone - b ros2 https://github.com/ros/urdf_tutorial.git src/urdf_tutorial
```

- **Compile source code**

```
colcon build --packages-select urdf_tutorial
```

- **Run the example**

```
ros2 launch urdf_tutorial display.launch.py model:=urdf/01-myfirst.urdf
```

Launch

The launch system in ROS 2 is responsible for helping users describe the configuration of their system and then executing it accordingly.The configuration of the system consists of the programs to run, where to run them, the arguments to pass to them, and ROS-specific conventions that make it easy to reuse components throughout the system by providing different configurations for each component. It is also responsible for monitoring the status of launched processes and reporting and/or responding to changes in the status of those processes.

Launch files written in Python, XML, or YAML can start and stop different nodes, as well as trigger and handle various events.

Specific reference: Official Tutorial

Setup

Create a new directory to store your launch file:

` ``bash mkdir launch

```
from launch import LaunchDescription
from launch_ros.actions import Node


def generate_launch_description():
    return LaunchDescription([
        Node(
            package='turtlesim',
            namespace='turtlesim1',
            executable='turtlesim_node',
            name='sim'
        ),
        Node(
            package='turtlesim',
            namespace='turtlesim2',
            executable='turtlesim_node',
            name='sim'
        ),
        Node(
            package='turtlesim',
            executable='mimic',
            name='mimic',
            remappings=[
                ('/input/pose', '/turtlesim1/turtle1/pose'),
                ('/output/cmd_vel', '/turtlesim2/turtle1/cmd_vel'),
            ]
        )
    ])
```

Run the ros2 launch file

To run the launch file created above, go to the directory you created earlier and run the following command:

The syntax format is:

```
ros2 launch <package_name> <launch_file_name>
```

```
cd launch
ros2 launch turtlesim_mimic_launch.py
```

- **launch help**

```
ros2 launch -h
```

- **Run Node**

```
ros2 launch turtlesim multisim.launch.py
```

- **Check the parameters of the launch file**

```
ros2 launch turtlebot3_fake_node turtlebot3_fake_node.launch.py -s
ros2 launch turtlebot3_fake_node turtlebot3_fake_node.launch. py --show-arguments
ros2 launch turtlebot3_bringup robot.launch.launch.py -s
```

- **Run launch file with parameters**

```
ros2 launch turtlebot3_bringup robot.launch.launch.py usb_port:=/dev/ opencr
```

- **Run the node and debug**

```
ros2 launch turtlesim turtlesim_node.launch.py -d
```

- **Only output node description**

```
ros2 launch turtlesim turtlesim_node.launch. py -p
```

- **Run component**

```
ros2 launch composition composition_demo.launch.py
```

Run

run is used to run a single node, component program.

- **run help**

```
ros2 run -h
```

- **run node**

```
ros2 run turtlesim turtlesim_node
```

- **run node with parameters**

```
ros2 run turtlesim turtlesim_node --ros-args -r __node:=turtle2 -r __ns:=/ns2
```

- **Run component container**

```
ros2 run rclcpp_components component_container
```

- **Run component** ```bash ros2 run composition manual_composition

Package

A package can be thought of as a container for your ROS 2 code. If you want to be able to install your code or share it with others, you need to organize it in a Packages allow you to publish your ROS 2 work and allow others to easily build and use it.

Package creation in ROS 2 uses ament as its build system and colcon as its build tool. You can create packages using the officially supported CMake or Python, but other build types do exist.

Specific parameters: Official tutorial

Creating a Workspace

Create a new directory for each new workspace. The name is not important, but it helps indicate the purpose of the workspace. Let's choose the directory name ros2_ws for the "development workspace":

```
mkdir -p ~/ros2_ws/src
cd ~/ros2_ws/src
```

- **pkg help**

`ros2 pkg -h`

- **List function packages**

```
ros2 pkg executable turtlesim
```

- **Output a function package executable program**

```
ros2 pkg executable turtlesim
```

- **Create Python Packages**

Before running the package creation command, make sure you are in the src folder.

```
cd ~/ros2_ws/src
```

The command syntax for creating a new package in ROS 2 is:

```
ros2 pkg create --build-type ament_python <package_name>
# You will use the optional parameter -- node-name Create a simple Hello World type executable file in the package.
ros2 pkg create --build-type ament_python --node-name my_node my_package
```

- **Build package**

Put the package in the workspace Especially valuable because you can build many packages at once by running colcon build in the workspace root. Otherwise, you would have to build each package individually.

```
# Return to the workspace directory:
cd ~/ros2_ws# Now you can build your package:
colcon build
```

- **Source setup file**

To use your new package and executable, first open a new terminal and source your main ROS 2 installation.

Then, from the ros2_ws directory, run the following command to source your workspace:

```
source install/setup.bash
```

Now that your workspace is added to your path, you will be able to use your new package's executable.

- **Use package**

To run the executable you created during package creation using the --node-name parameter, enter the following command:

```
ros2 run my_package my_node
```

A brief introduction and use of rviz2

rviz is a three-dimensional visualization platform in ROS. On the one hand, it can realize the graphical display of external information. On the other hand, it can also release control information to objects through rviz, thereby realizing the monitoring and control of robots.

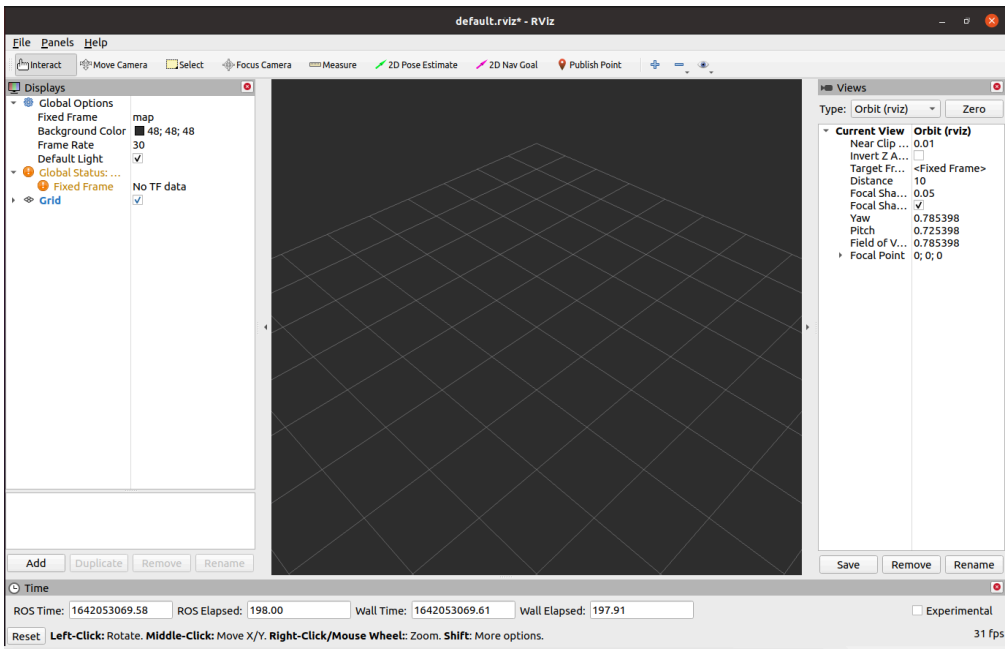
Introduction to rviz2

The successful installation of ros2 indicates that rviz2 is also successfully installed, because the installation of ros2 includes rviz2.

Open a new terminal (shortcut `Ctrl+Alt+T`) and enter the command to open rviz2

```
rviz2
```

Open rviz2 and the following interface will be displayed:



Introduction to each area

- On the left is the display list. The display is something that draws something in the 3D world and may have some options available in the display list.
- Above is the toolbar, which allows the user to select multiple functions with various function keys
- The middle part is the 3D view: it is the main screen for viewing various data in three dimensions. The background color, fixed frame, grid, etc. of the 3D view can be set in detail in the Global Options and Grid items displayed on the left.
- Below is the time display area, including system time and ROS time.
- On the right is the observation angle setting area, where different observation angles can be set.

In this section, we only give a rough introduction. If you want to know more details, you can go to the User Guide to check it out.

mycobot_ros2 installation and update

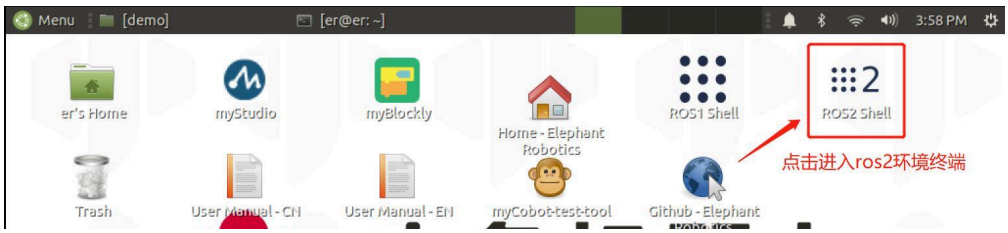
- **M5 version:** Please check the end of the ROS2 installation section.
- **PI version (Ubuntu 20.04):**

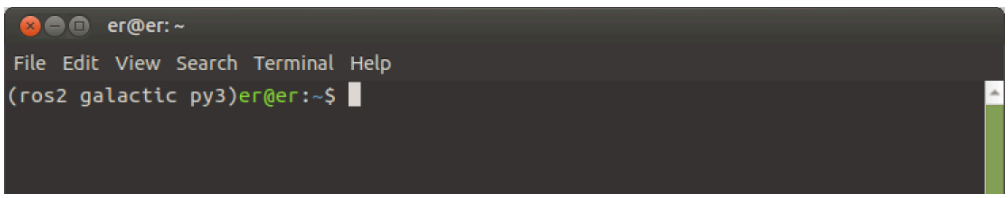
`mycobot_ros2` is a ROS package launched by ElephantRobotics that is compatible with various types of desktop robotic arms.

Project address: https://github.com/elephantrobotics/mycobot_ros2

The official default workspace is `colcon_ws` .

Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:





Then enter the following command:

```
cd ~/colcon_ws/src # Enter the src folder in the workspace
# Clone the code on github
git clone https://github.com/elephantrobotics/mycobot_ros2.git
cd .. # Return to the workspace
colcon build --symlink-install # Build the code in the workspace, --symlink-install: Avoid recompiling every time you adju
source install/setup.bash # Add environment variables
```

Note: If `/home/er/colcon_ws/src (equivalent to ~/colcon_ws/src)` directory, you need to delete the original `mycobot_ros2` first, and then execute the above command.

Simple use

Start through the launch.py file

This example is based on the fact that you have completed Environment Setup and successfully copied the company's code from GitHub.

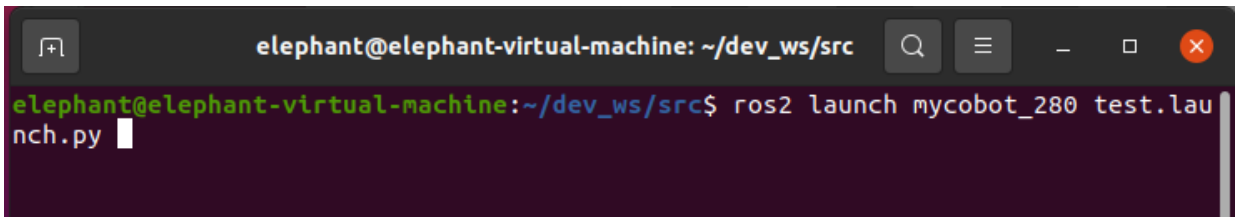
Open a console terminal (shortcut key `Ctrl+Alt+T`) Enter the following command to **ROS2 environment configuration**.

```
cd ~/colcon_ws
colcon build --symlink-install
source install/setup.bash
```

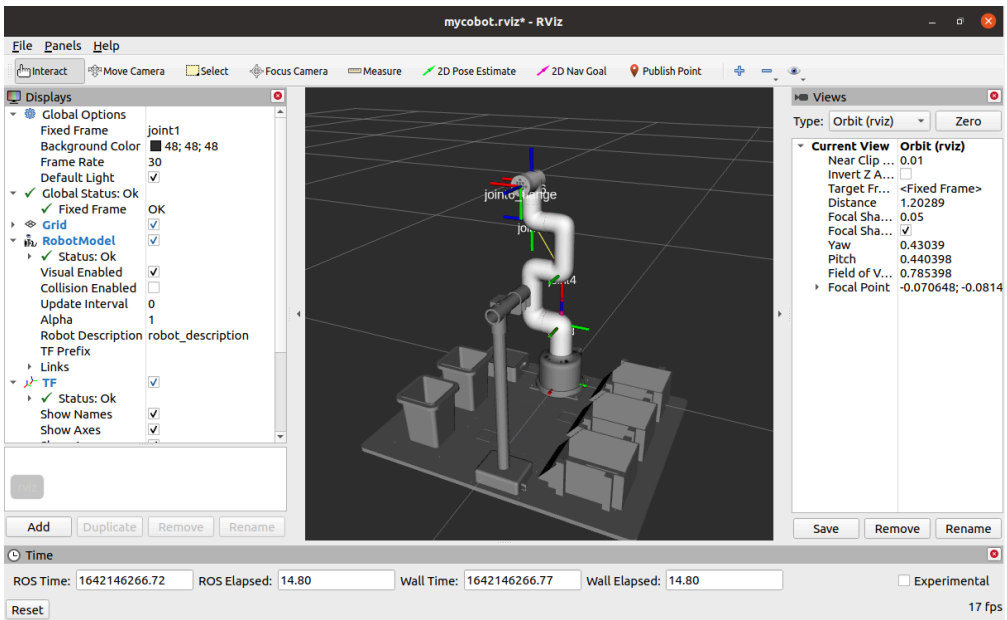
Enter again:

- mycobot 280-M5 version:

```
ros2 launch mycobot_280 test.launch.py
```



Open rviz2 and get the following result:



If you want to learn more about rviz, you can go to the official document to view it

M5 version prerequisites

- Open the console terminal (shortcut key `Ctrl+Alt+T`), open the terminal window to view the device name:

```
# View the device name of the robot arm
ls /dev/ttyUSB* # Old version myCobot280 M5

# If the terminal does not display the /dev/ttyUSB related name, you need to use the following command
ls /dev/ttyACM* # New version myCobot280 M5
```

- Grant serial port permissions to the robot:

```
# The default device name is /dev/ttyUSB0. If the device name is not the default value, you need to modify it.
sudo chmod 777 /dev/ttyUSB0 # Old version myCobot280 M5

sudo chmod 777 /dev/ttyACM0 # New version myCobot280 M5
```

Then enter the user password (**Note:** The password is not displayed, just enter it correctly).

280 series rviz user guide

Robot arm control

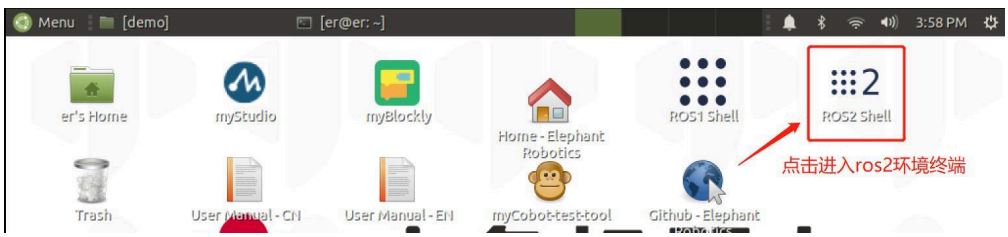
> **Note:** For better motion effects, the Atom firmware version of the end arm is 6.5, and the python driver library pymycobot version is 3.5.3

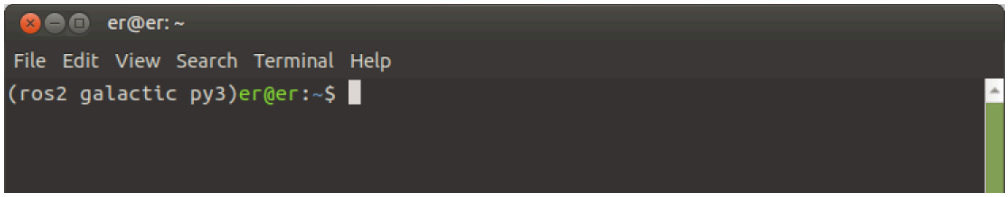
1 Slider control

Open a command line and run:

- mycobot 280-PI version:

Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:

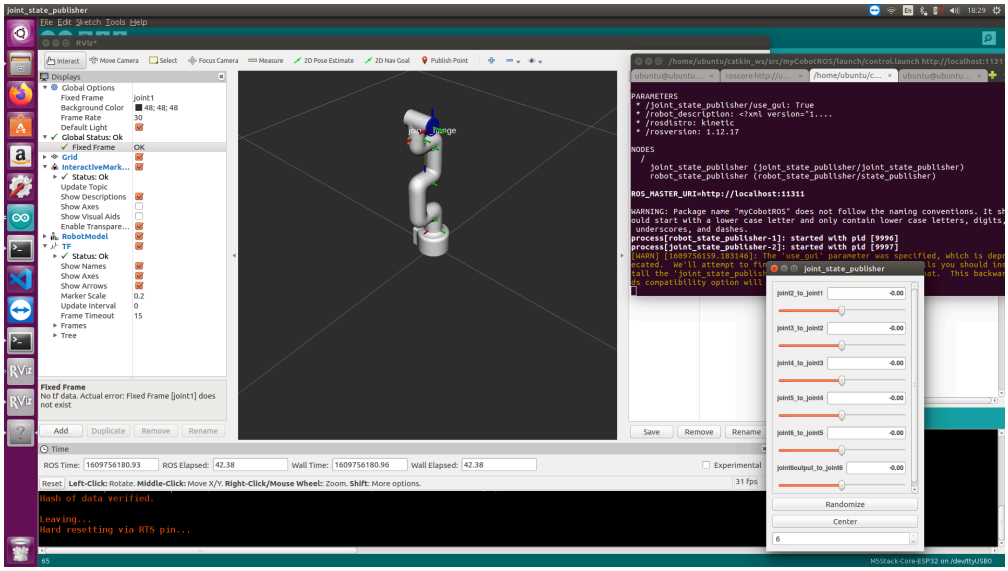




Then run the command:

```
# The default serial port name of mycobot 280-PI version is "/dev/ttyAMA0" and the baud rate is 1000000.
ros2 launch mycobot_280pi slider_control.launch.py
```

It will **open rviz and a slider component**, and you will see the following screen (the screen of the Raspberry Pi version is slightly different, which does not affect the use):



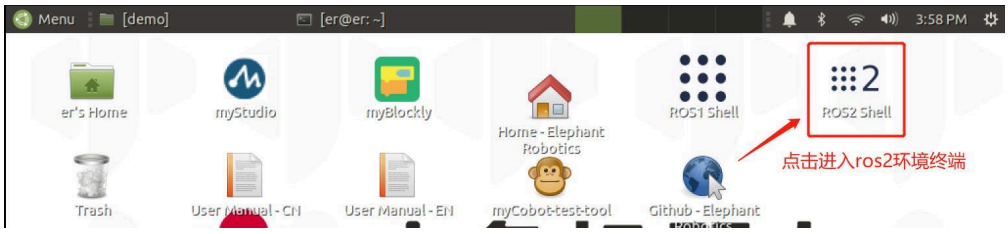
Then you can **control the movement of the model in rviz by dragging the slider**. The real mycobot will move with it.

Please note: Since the robot arm will move to the current position of the model when the command is entered, please make sure that the model in rviz does not appear to be through the model before you use the command Do not drag the slider quickly after connecting the robot arm to prevent damage to the robot arm

2 Model following

In addition to the above control, we can also **let the model follow the movement of the real robot arm**. Open a command line and run:

Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:



Then run the command:

```
# The default serial port name of mycobot 280-PI version is "/dev/ttyAMA0" and the baud rate is 1000000.
ros2 launch mycobot_280pi mycobot_follow.launch.py
```

It will **open rviz to show the model following.**

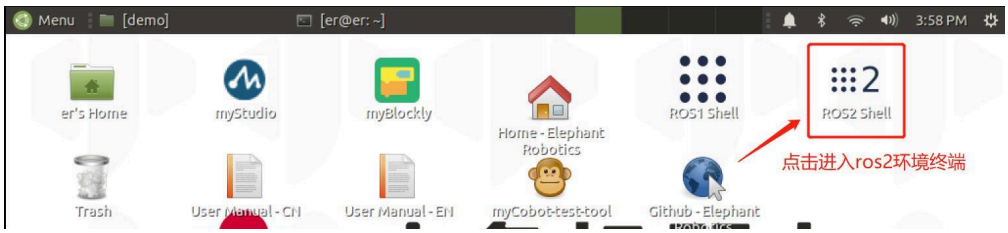
3 GUI control

Based on the previous, this package also **provides a simple Gui control interface**. This method is intended to allow real robotic arms to interact with each other. Please connect mycobot.

Open the command line:

- mycobot 280-PI version:

Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:

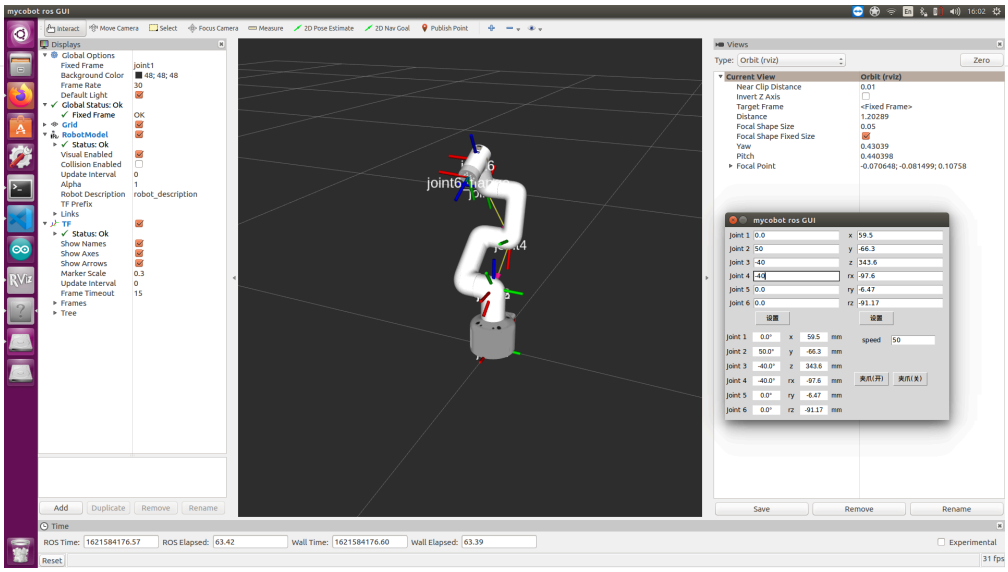


Then run the command:

```
# The default serial port name of mycobot 280-PI version is "/dev/ttyAMA0" and the baud rate is 1000000.
ros2 launch mycobot_280pi simple_gui.launch.py
```

Then run the command:

```
# The default serial port name of mycobot 280-JetsonNano version is "/dev/ttyTHS1" and the baud rate is 1000000.
ros2 launch mycobot_280jn simple_gui.launch.py
```



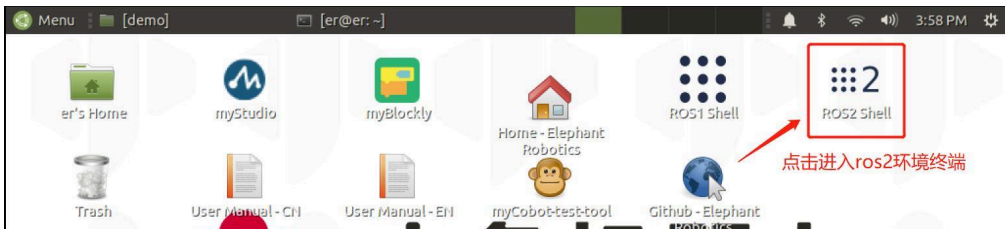
4 Keyboard control

Keyboard control function has been added to the `mycobot_280` package, and it is synchronized in real time in rviz. This function relies on pythonApi, so make sure it is connected to the real robot arm.

Open a command line and run:

- mycobot 280-PI version:

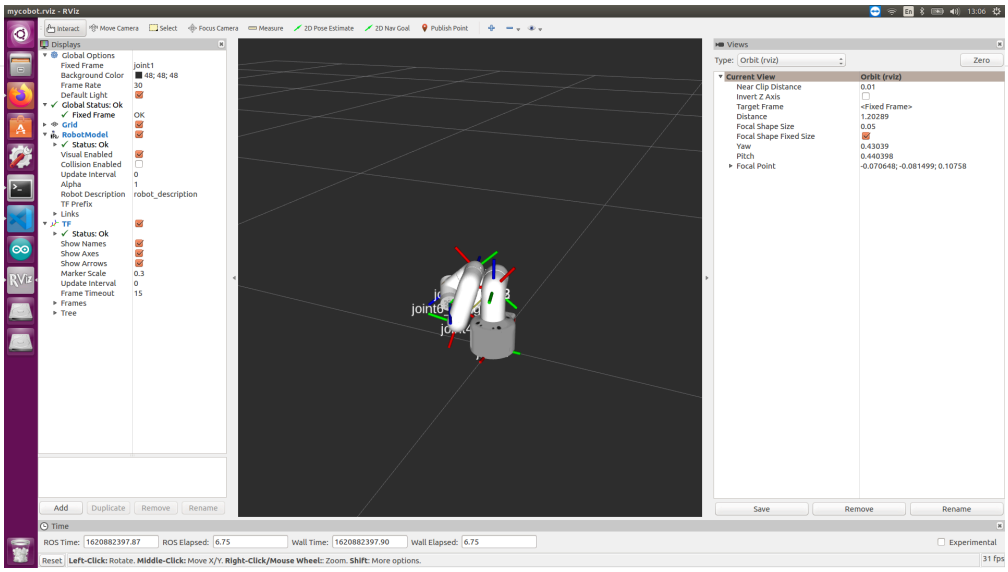
Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:



Then run the command:

```
# The default serial port name of mycobot 280-PI version is "/dev/ttyAMA0" and the baud rate is 1000000.

ros2 launch mycobot_280pi teleop_keyboard.launch.py
```

The running effect is as follows:



Mycobot information will be output on the command line, as follows:

```bash [INFO] [launch]: All log files can be found below /home/elephant/.ros/log/2022-05-19-16-25-45-949761-elephant-virtual-machine-19111 [INFO] [launch]: Default logging verbosity is set to INFO [INFO] [robot_state _publisher-1]: process started with pid [19114] [INFO] [rviz2-2]: process started with pid [19116] [INFO] [follow_display-3]: process started with pid [19118] [robot_state_publisher-1] Parsing robot urdf XML string. children [robot_state_publisher-1] Link joint3 had 1 children [robot_state_publisher-1] Link joint4 had 1 children [robot_state_publisher-1] Link joint5 had 1 children [robot_state_publisher-1] Link joint6 had 1 children [robot_state_publisher-1] Link joint6_flange had 0 children [robot_state_publisher-1] [INFO] [ 1652948746.290904045] [robot_state_publisher]: got segment joint1 [robot_state_publisher-1] [INFO] [1652948746.290967253] [robot_state_publisher]: got segment joint2 [robot_state_publisher-1] [INFO] [1652948746.290973124] [robot_state_publisher]: got segment joint3 [robot_state_publisher-1] [INFO] [1652948746.290977490] [robot_state_publisher]: got segment joint4 [robot_state_publisher-1] [INFO] [1652948746.2 90981670] [robot_state_publisher]: got segment joint5 [robot_state_publisher-1] [INFO] [1652948746.290985737] [robot_state_publisher]: got segment joint6 [robot_state_publisher-1] [INFO] [1652948746.290989943] [robot_state_publisher]: got segment joint6_flange [follow_display-3] [INFO] [1652948746.664601707] [follow_display]: port:/dev/ttyUSB0, baud:115200 [rviz2-2] [INFO] [1652948746.828773551] [rviz2]: Stereo is NOT SUPPORTED [rviz2-2] [INFO] [1652948746.830452458] [rviz2]: OpenGl version: 4.1 (GLSL 4.1) [rviz2-2] [INFO] [1652948746.874021926] [rviz2]: Stereo is NOT SUPPORTED [rviz2-2] Parsing robot urdf xml string.
```

```
- mycobot 280-PI version:

Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environ

<img src =../../../../../resource\3-FunctionsAndApplications\6.developmentGuide\ROS\12.2-ROS2\rviz2/12.2.7-10.jpg
width ="500" align = "center">

<img src =../../../../../resource\3-FunctionsAndApplications\6.developmentGuide\ROS\12.2-ROS2\rviz2/12.2.7-11.jpg
width ="500" align = "center">

<img src =../../../../../resource\3-FunctionsAndApplications\6.developmentGuide\ROS\12.2-ROS2\rviz2/12.2.7-12.png
width ="500" align = "center">

Then run the command:

```bash
ros2 run mycobot_280pi teleop_keyboard
```

You will see the following output in the command line:

```
Mycobot Teleop Keyboard Controller
---------------------------
Movimg options(control coordinations [x,y,z,rx,ry,rz]):
w(x+)

a(y-) s(x-) d(y+)

z(z-) x(z+)

u(rx+) i(ry+) o(rz+)

j(rx-) k(ry-) l(rz-)

Gripper control:
g - open
h - close

Other:
1 - Go to init pose
2 - Go to home pose
3 - Resave home pose
q - Quit

currently: speed: 10 change percent: 2
```

In this terminal, you can control the state of the robot and move the robot by pressing keys in the command line.
```

5 End effector

- **Supported end effectors:** myCobot vertical suction pump V2.0, camera flange
- **Applicable devices:** myCobot 280 M5, myCobot 280 PI

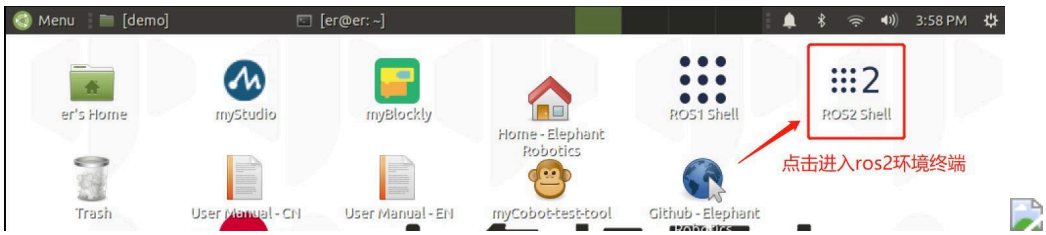
5.1 myCobot vertical suction pump V2.0

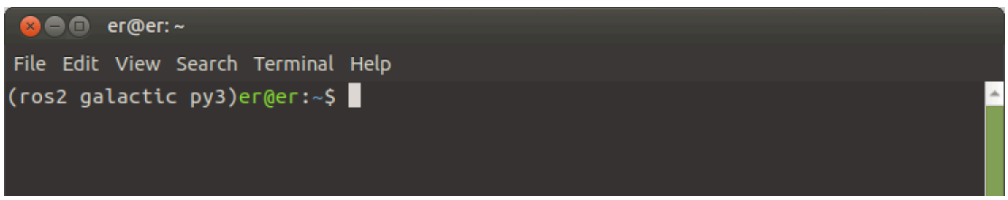
1 Load the model

Open a command line and run:

- mycobot 280-PI version:

Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:

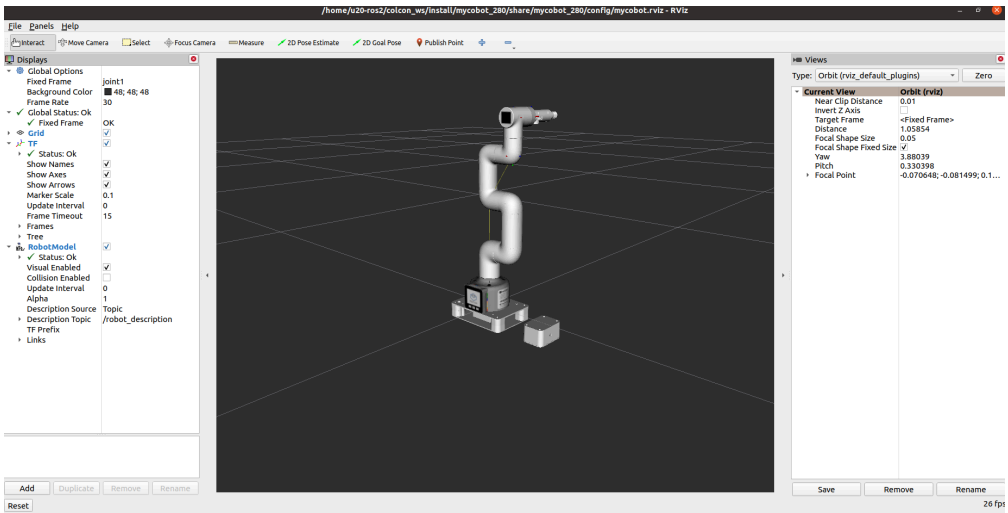




Then run the command:

```
ros2 launch mycobot_280pi test_pump.launch.py
```

It will **open rviz**, and you will see the following screen (the screen of the Raspberry Pi version is slightly different, which does not affect the use):



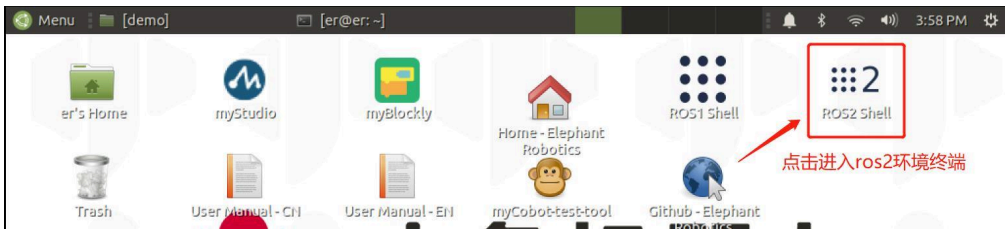
2 Slider control

> **Note: This function only supports the control of the robot arm**

Open a command line and run:

- mycobot 280-PI version:

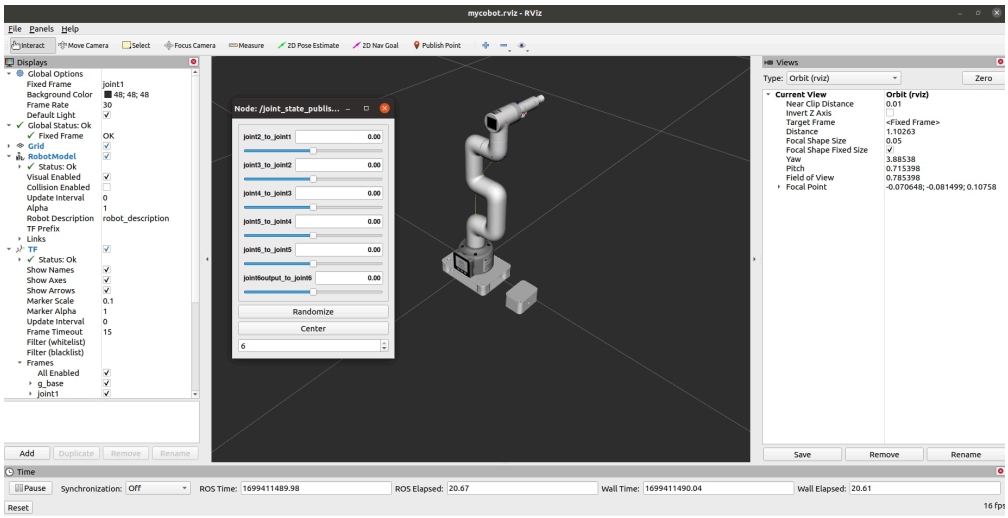
Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:



Then run the command:

```
# The default serial port name of mycobot 280-PI version is "/dev/ttyAMA0" and the baud rate is 1000000.
ros2 launch mycobot_280pi slider_control_pump.launch.py
```

It will **open rviz and a slider component**, you will see the following screen (the Raspberry Pi version screen is slightly different, which does not affect the use):



Then you can **control the movement of the model in rviz by dragging the slider**. The real mycobot will move with it.

Please note: Since the robot arm will move to the current position of the model while the command is input, please make sure that the model in rviz does not appear to be through the model before you use the command Do not drag the slider quickly after connecting the robot arm to prevent damage to the robot arm

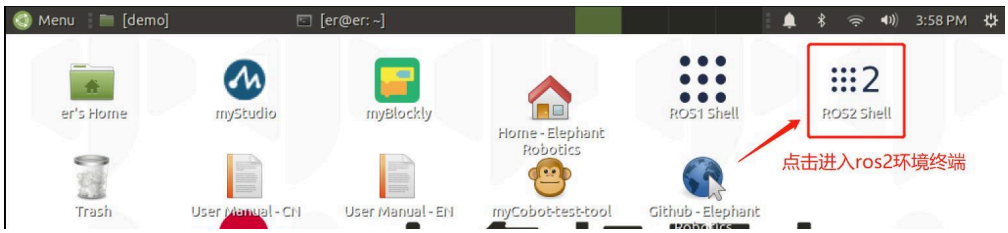
5.2 Camera flange

1 Load the model

Open a command line and run:

- mycobot 280-PI version:

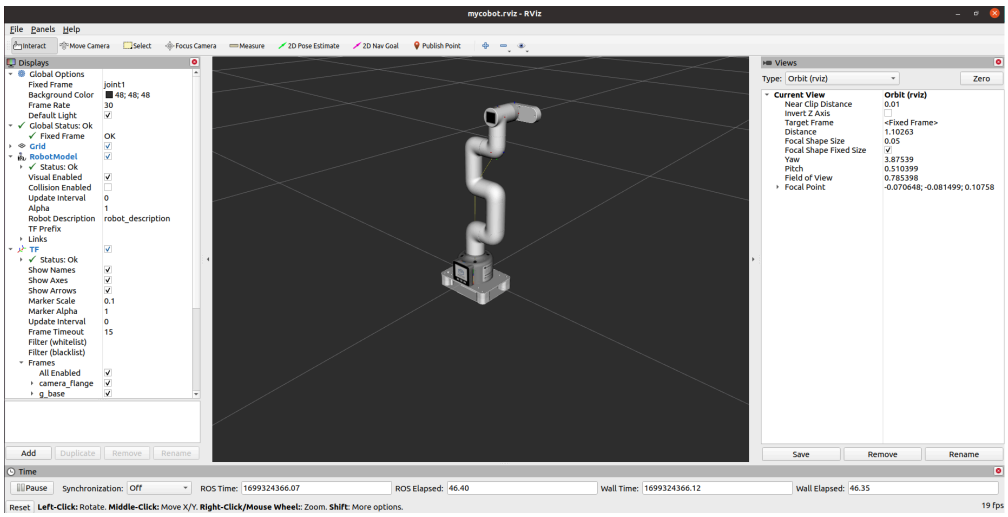
Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:



Then run the command:

```
ros2 launch mycobot_280pi test_camera_flange.launch.py
```

It will **open rviz**, you will see the following screen (the screen of the Raspberry Pi version is slightly different, which does not affect the use):



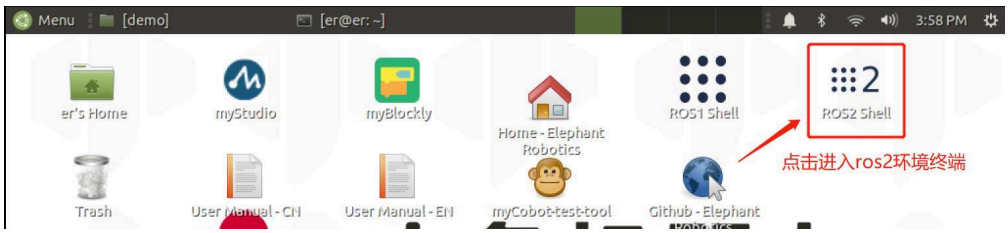
2 Slider control

> **Note: This function only supports the control of the robot arm**

Open a command line and run:

- mycobot 280-PI version:

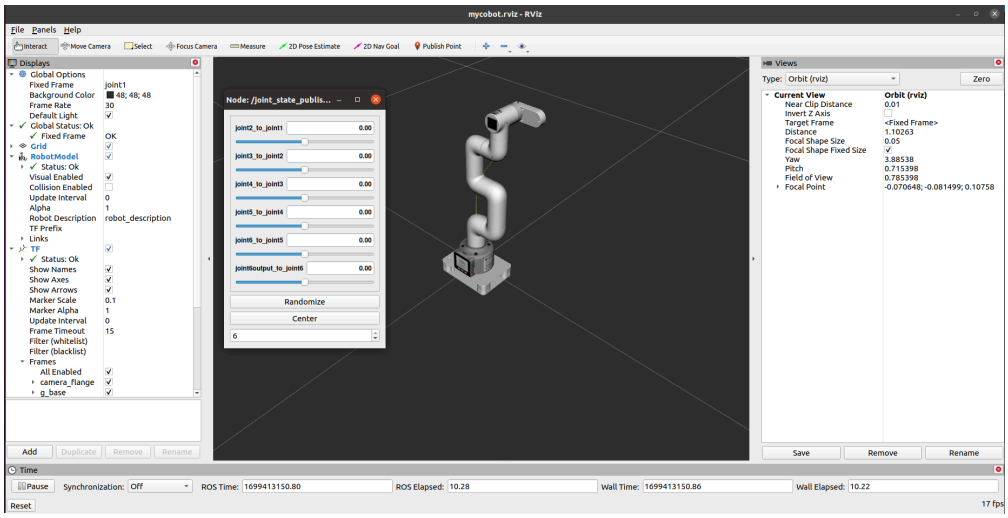
Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:



Then run the command:

```
# The default serial port name of mycobot 280-PI version is "/dev/ttyAMA0" and the baud rate is 1000000.
ros2 launch mycobot_280pi slider_control_camera_flange.launch.py
```

It will **open rviz and a slider component**, and you will see the following screen (the screen of the Raspberry Pi version is slightly different, which does not affect the use):



Then you can **control the movement of the model in rviz by dragging the slider**. The real mycobot will move with it.

Please note: Since the robot arm will move to the current position of the model when the command is entered, please make sure that the model in rviz does not appear to be through the model before you use the command. Do not drag the slider quickly after connecting the robot arm to prevent damage to the robot

arm.

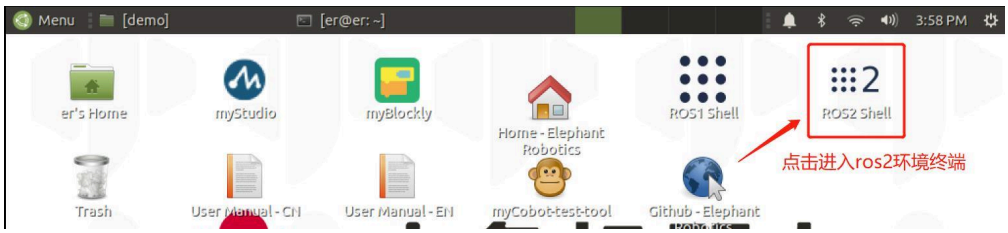
5.3 Camera flange && pump

1 Load the model

Open a command line and run:

- mycobot 280-PI version:

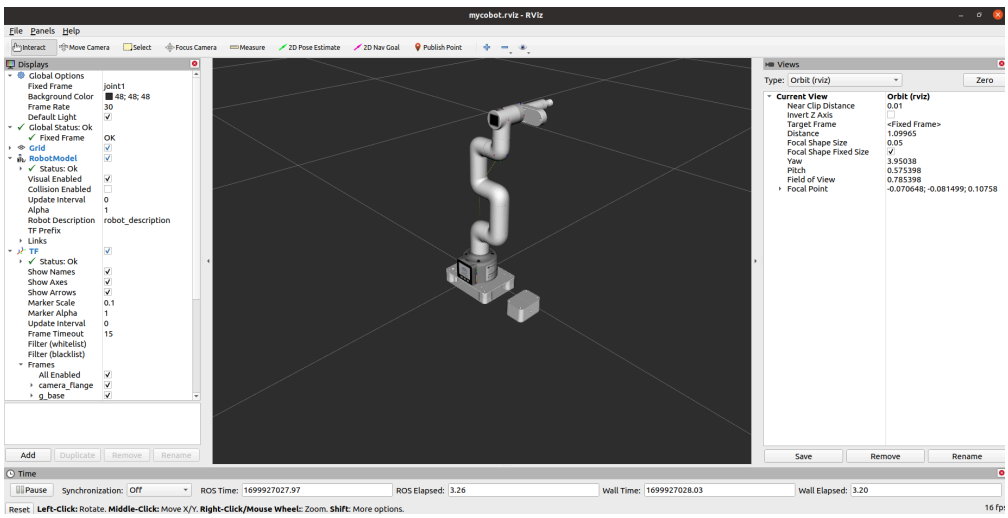
Click the `ROS2 Shell` icon on the desktop or the corresponding icon in the bar below the desktop to open the ROS2 environment terminal:



Then run the command:

```
ros2 launch mycobot_280pi test_camera_flange_pump.launch.py
```

It will **open rviz**, you will see the following screen (the screen of the Raspberry Pi version is slightly different, which does not affect the use):



5.3 URDF model address

1 myCobot vertical suction pump V2.0

- myCobot 280-PI version

2 Camera flange

- myCobot 280-PI Version

3 Camera Flange && Pump

- myCobot 280-PI version

What is myBlockly?

myBlockly is a fully visual modular programming software, a graphical programming language.

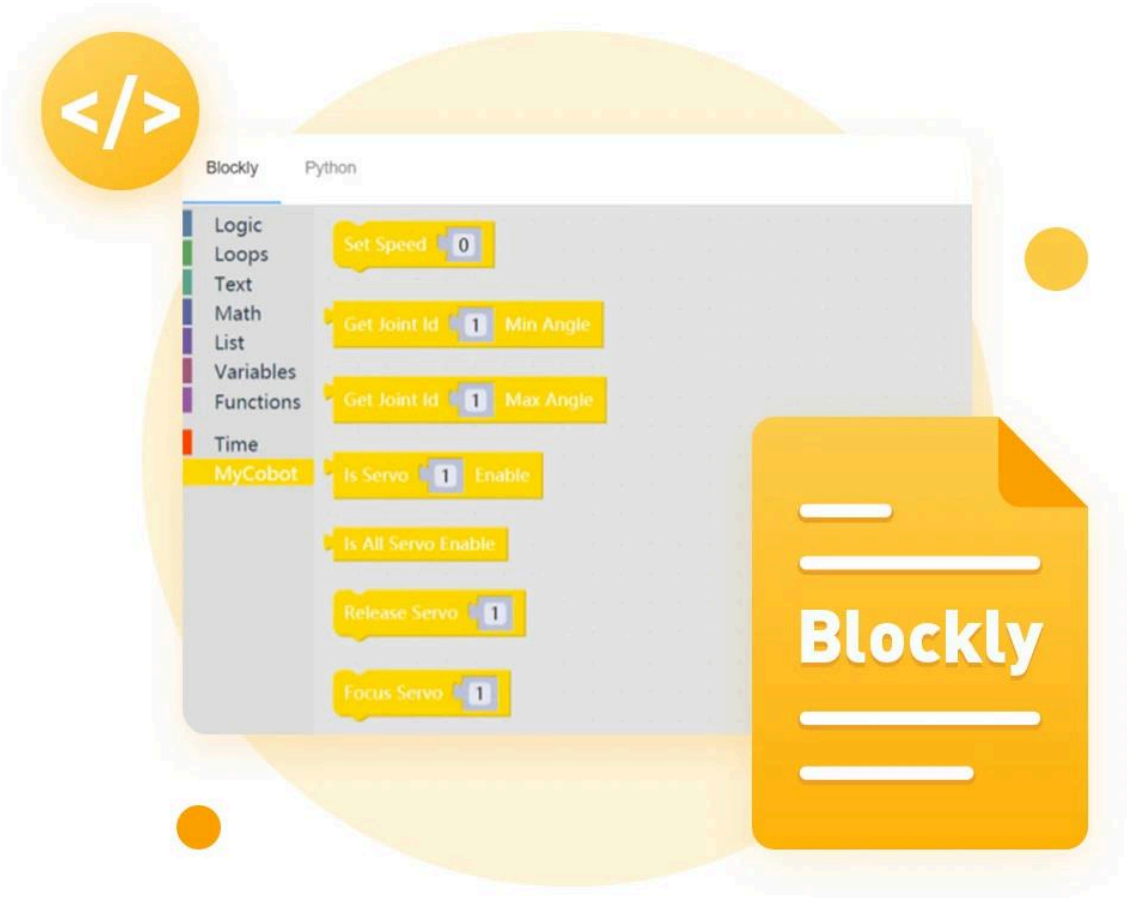
myBlockly is similar to MIT's children's programming language Scratch in terms of function/design.

When using **myBlockly**, users can drag and drop modules to build code logic, which is very similar to building blocks.

From the user's perspective, **myBlockly** is a simple and easy-to-use visual tool for generating code. From the developer's perspective, **myBlockly** is a text box that contains the code entered by the user.

The process of generating code into the text box is the process of the user dragging in **myBlockly**.

myBlockly installation



myBlockly download address:

- GitHub address: https://github.com/elephantrobotics/myblockly-package/releases
- Official website address: https://www.elephantrobotics.com/download/

Applicable devices:

- myCobot 280
- myCobot 280 M5
- **myCobot 280 PI**
- myCobot 280 Jetson Nano
- myCobot 280 for Arduino

Prerequisites:

- **Pi \ jetsonnano** series, **ATOM** burn the latest version of **atomMain** (factory default burned)
- Configure **Python environment**, please refer to the Python chapter

myBlockly Development and Use Guide

You can use myBlockly to develop our robotic arm according to the following guidelines

1.MyBlockly Initial Use

2.Control RGB Light Board

3.Control the Robotic Arm to Return to Origin

4.Control Single Joint Movement

5.Control Multiple Joints

6.Control the robot arm to swing left and right

7.Control the robot arm to dance

8.Use of gripper

9.Use of suction pump

10.Gripper test

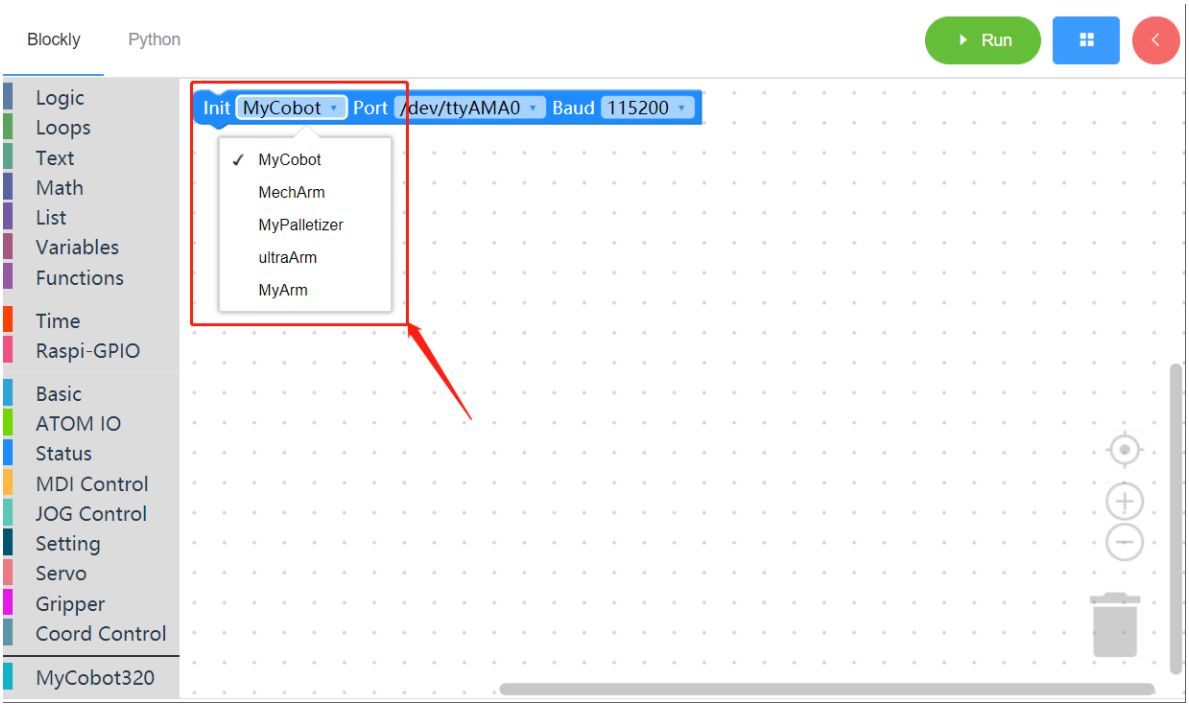
11.IO test

12.Q&A

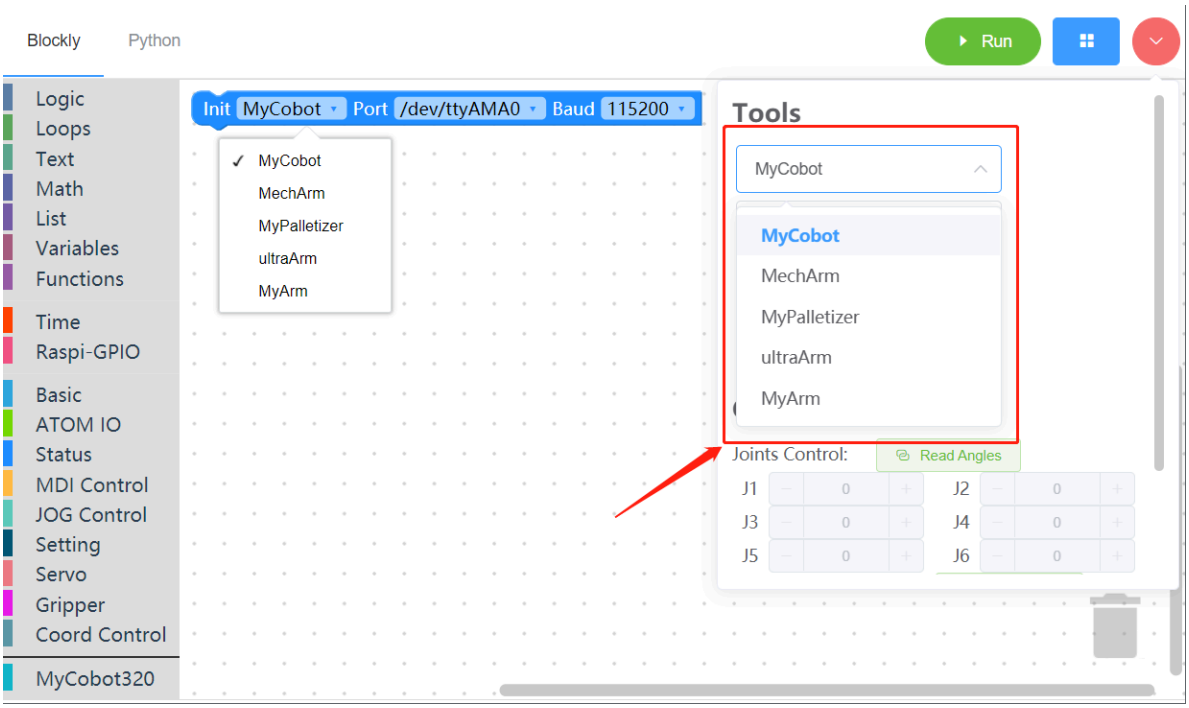
Initial use of myBlockly

Prerequisites

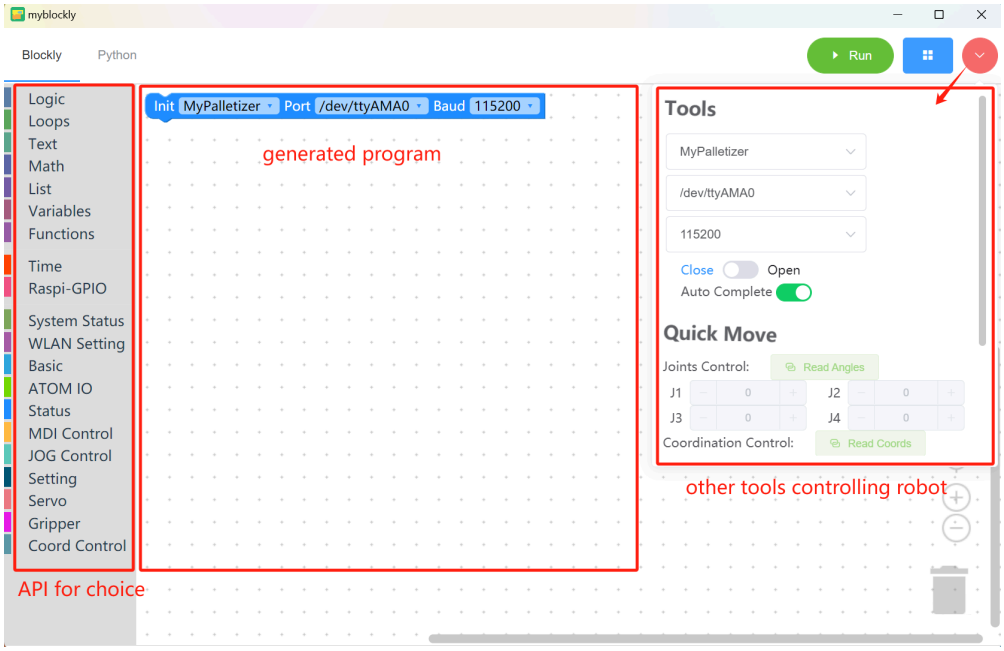
- Before you start programming, you must select the corresponding **machine model**, otherwise it is easy to cause hardware damage



- When controlling the machine with the control panel, you must select the corresponding **machine model**, otherwise it is easy to cause hardware damage



myBlockly interface display



- Module bar:
- Contains the method modules required for program writing, which can be placed in the program editing area for splicing by mouse
- MyCobot320 module
- Small toolbar:

Click the pink button in the upper right corner to display a small toolbar, where you can select the correct model, serial port number and baud rate. You can also get the real-time joint angle and coordinates of the robot arm by clicking the "Read Angle" or "Read Coordinate" button. Click "+/-" in the joint control or coordinate control bar to control the movement of the robot arm.

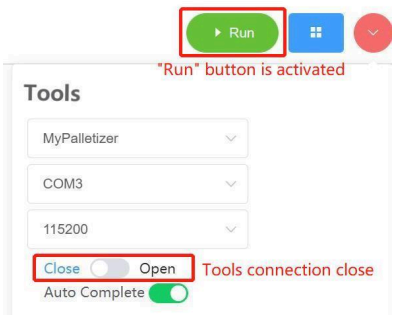
- Program editing area:
- Before running the program, you need to select the correct model, port and baud rate in the initialization module or the small toolbar, otherwise the program will not run normally.
- Drag the required module methods to this area and splice them to realize your own program.
- If the baud rate and serial port have been modified in the right toolbar, but it is still /dev/ttyAMA0, it is due to the myBlockly version. You need to update the software version on the official website first (the latest version will change the information in the editing area after selecting the serial port and baud rate in the toolbar).

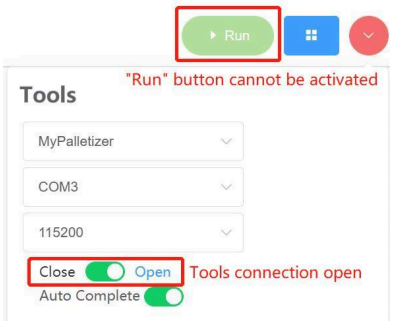
Note:

1. The baud rate of the M5Stack series is generally 115200, and the baud rate of the Raspberry Pi series is generally 1000000.

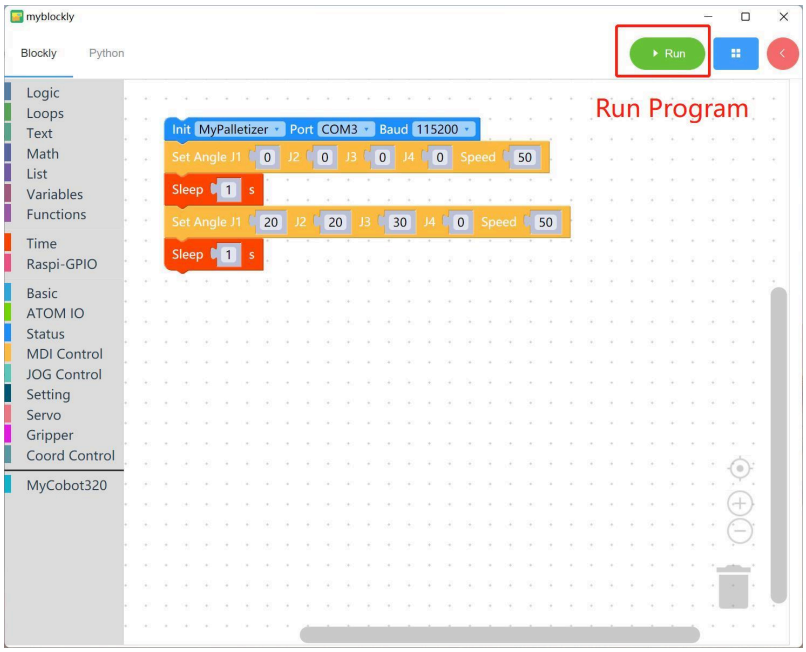
Machine model	Serial port number	Baud rate
260 M5	Win: COM*; Linux: /dev/ttyUSB*;	115200
270 M5	Win: COM*; Linux: /dev/ttyUSB*;	115200
280 M5	Win: COM*; Linux: /dev/ttyUSB*;	115200
320 M5	Win: COM*; Linux: /dev/ttyUSB*;	115200
260 PI	/dev/ttyAMA0	1000000
270 PI	/dev/ttyAMA0	1000000
280 PI	**/dev/ttyAMA0**	**1000000**
320 PI	/dev/ttyAMA0	115200
280 Jetson Nano	/dev/ttyTHS1	1000000
280 Arduino	Win: COM*; Linux: /dev/ttyUSB* or /dev/ttyACM** ;	1000000

1. To check the serial port number and baud rate of the machine, please go to **myStudio Driver Installation** section.
2. When the program cannot run, please check whether the small toolbar is disconnected (as shown in the figure below).





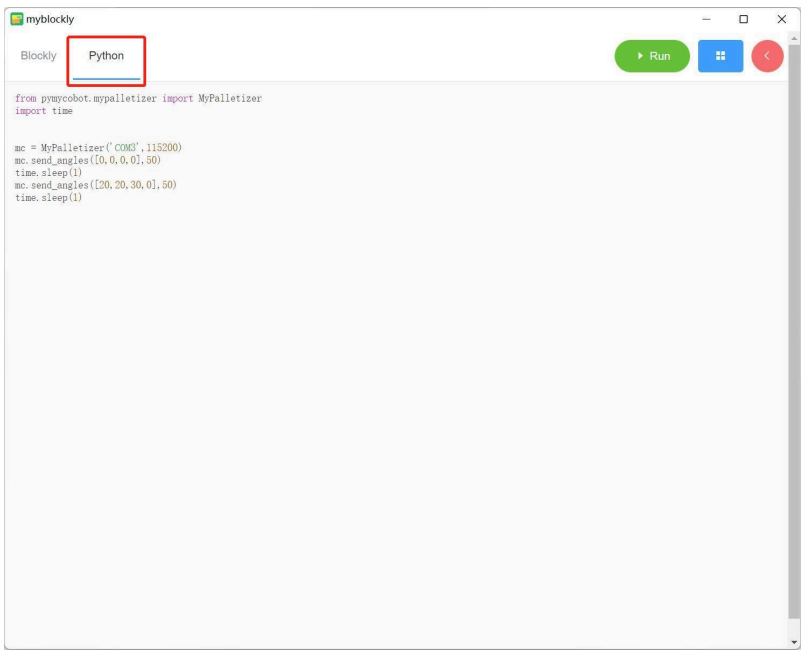
Program Run



Drag the desired method module, edit your own program (as shown above), combine each module structure together (there is a ki sound), and then click "Run" to upload the code to the robot arm to run.

Note: The program that operates the robot arm movement takes time to complete, so after an action, you need to connect a `sleep` module to give the robot arm time to move before the next movement. (Decide the required time according to the situation. The robot arm is set by default to run myBlockly with a minimum sleep time of no less than 0.5s) Otherwise, the robot arm will not be able to achieve the desired movement.

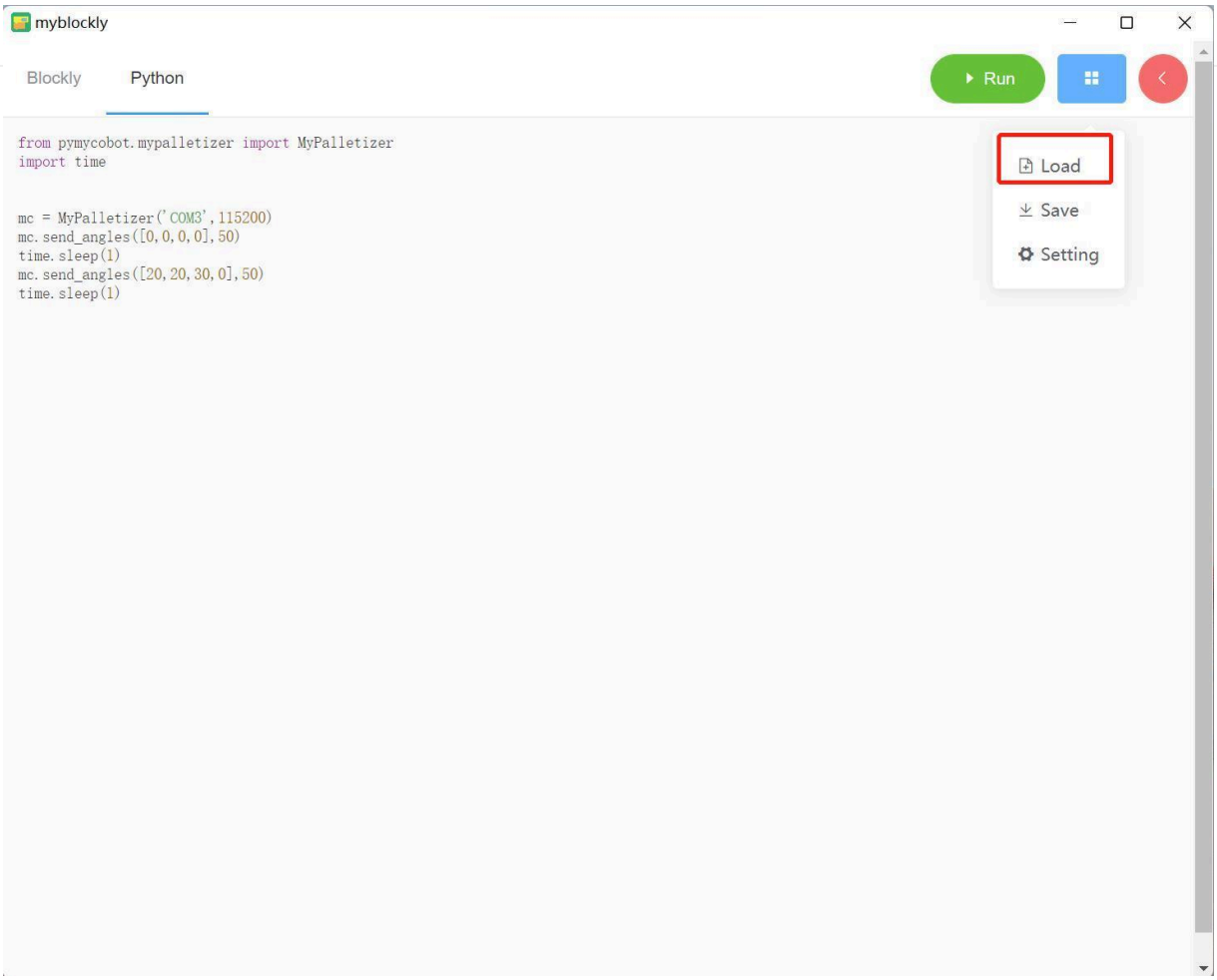
Click the "Python" option in the upper left corner to view the corresponding Python code, as shown in the figure below.



Program Saving and Loading

MyBlockly programs are saved in *.json format. Click the blue box in the upper right corner of the interface. Click the "Save" option to save the program.

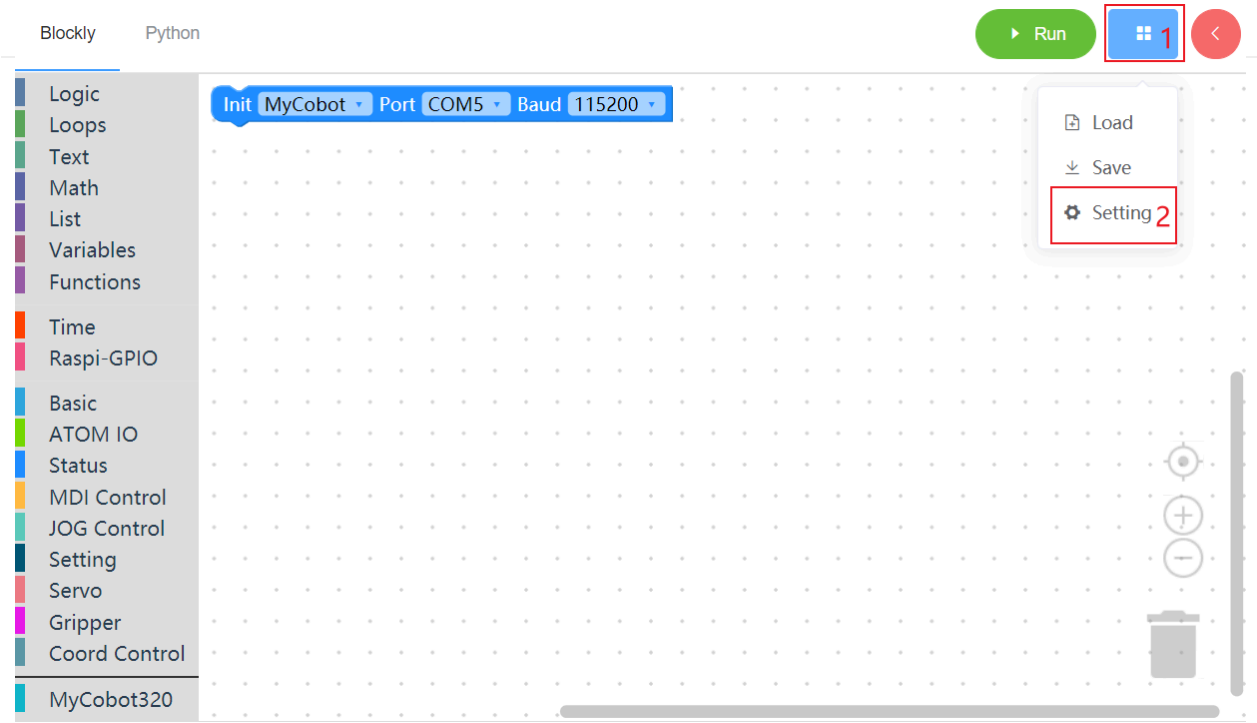
Similarly, click the blue box and click the "Load" option to import the saved program.

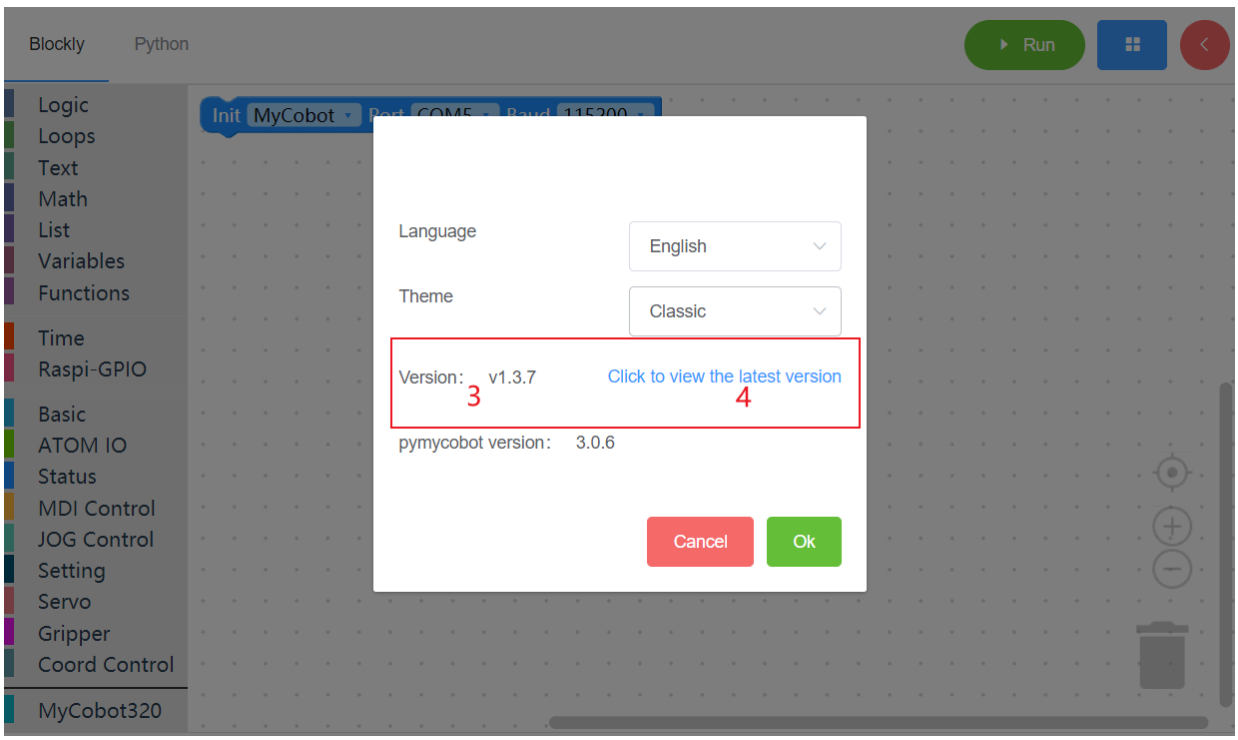


How to install and update the software

The installation and update of myBlockly need to go to the official website to download the latest version.

Inside the software, you can update the software through the following steps.


Blockly
Python
Run
1
Logic
Loops
Text
Math
List
Variables
Functions
Time
Raspi-GPIO
Basic
ATOM IO
Status
MDI Control
JOG Control
Setting
Servo
Gripper
Coord Control
MyCobot320
Init MyCobot Port COM5 Baud 115200
Load
Save
Setting
2


Blockly
Python
Run
Logic
Loops
Text
Math
List
Variables
Functions
Time
Raspi-GPIO
Basic
ATOM IO
Status
MDI Control
JOG Control
Setting
Servo
Gripper
Coord Control
MyCobot320
Language
English
Theme
Classic
Version:
3
v1.3.7
Click to view the latest version
4
pymycobot version:
3.0.6
Cancel
Ok

Control RGB light board

Preparation before starting

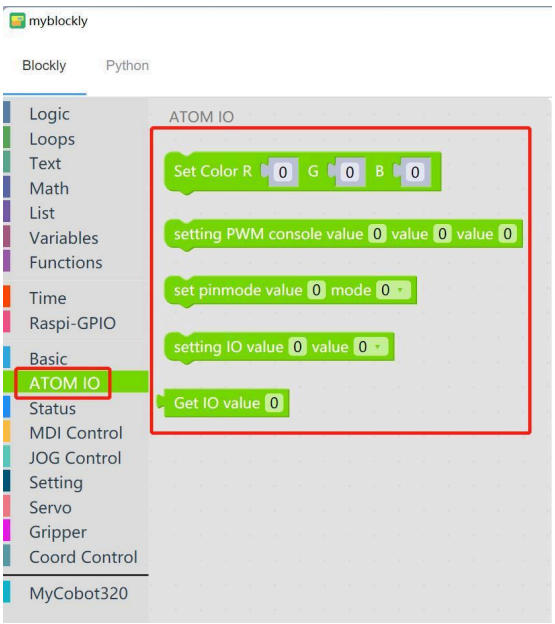
Other series: Make sure the machine is normal

Learning content in this chapter

How to use myBlockly to control the RGB light board

API introduction

- Method module: `Color setting`



- Scope of application: myCobot 280 series, myCobot 320 series, myCobot Pro 600 series and myPalletizer 260 series

- Parameter introduction:
- The parameters to be set are R (`x`), G (`x`), B (`x`), and different values represent different colors.
- Parameter range (for details, please refer to the RGB parameter table):

R: 0~255

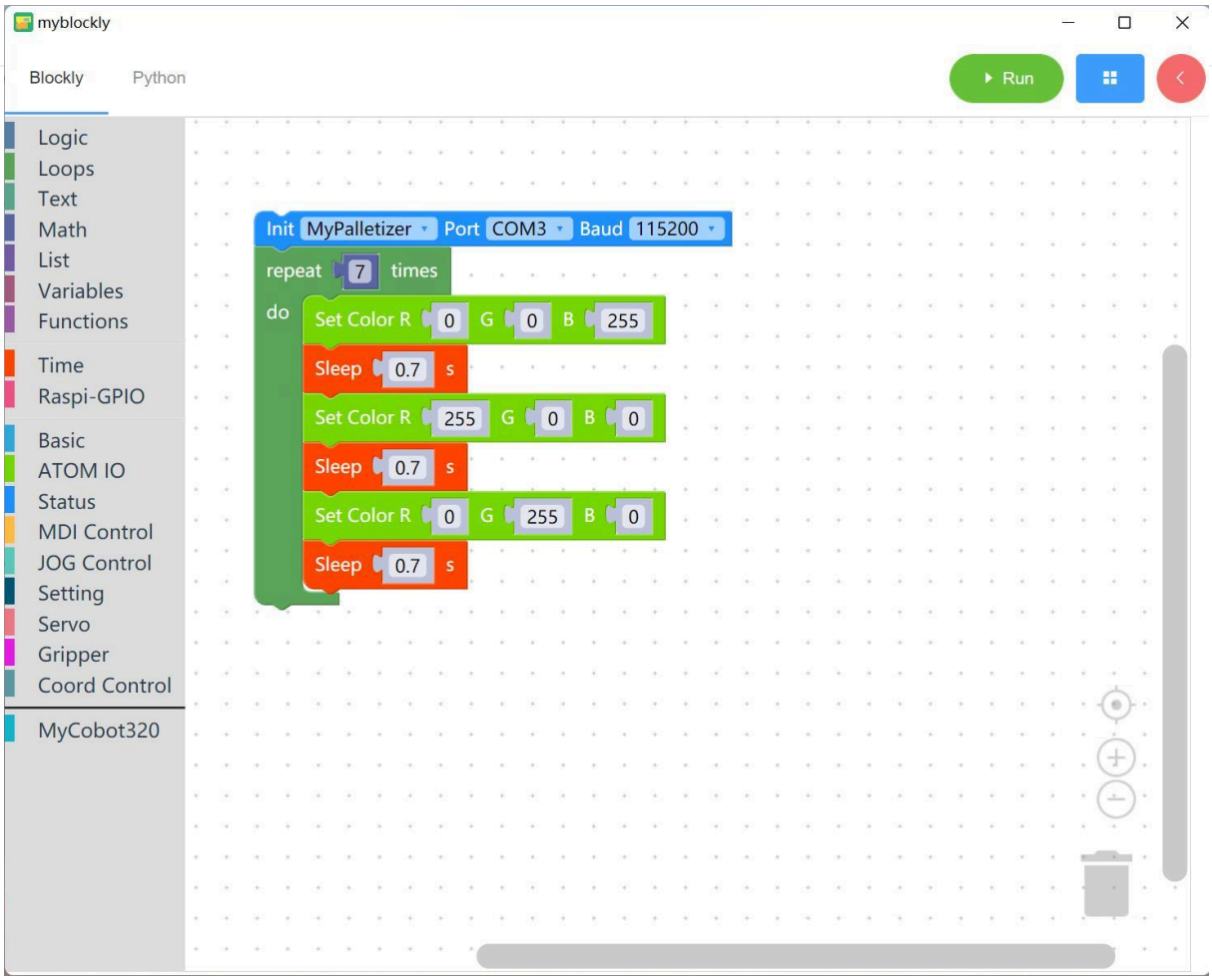
G: 0~255

B: 0~255

- Purpose: Control the color of the RGB light board.

Simple demonstration

- Graphic code is as follows:



- Implemented content:

Control the color of the robot arm RGB light board to change from "blue-red-green" in sequence, and the whole process is repeated seven times.

Control the robot arm to return to the origin

Preparation before starting

M5Stack series: Make sure the robot arm is connected to the computer

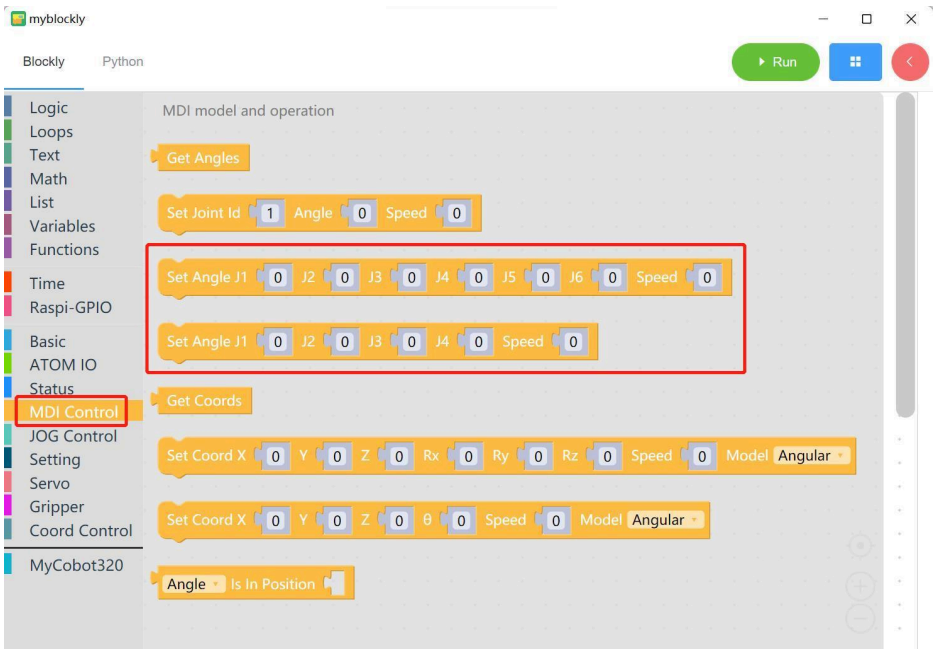
Other series: Make sure the machine is normal

Learning content in this chapter

How to use myBlockly to control the robot arm to return to the origin

API introduction

- Method module: `Set angle`



- Scope of application: This module is applicable to the 6-axis myCobot 280 series, mechArm series, myCobot 320 series

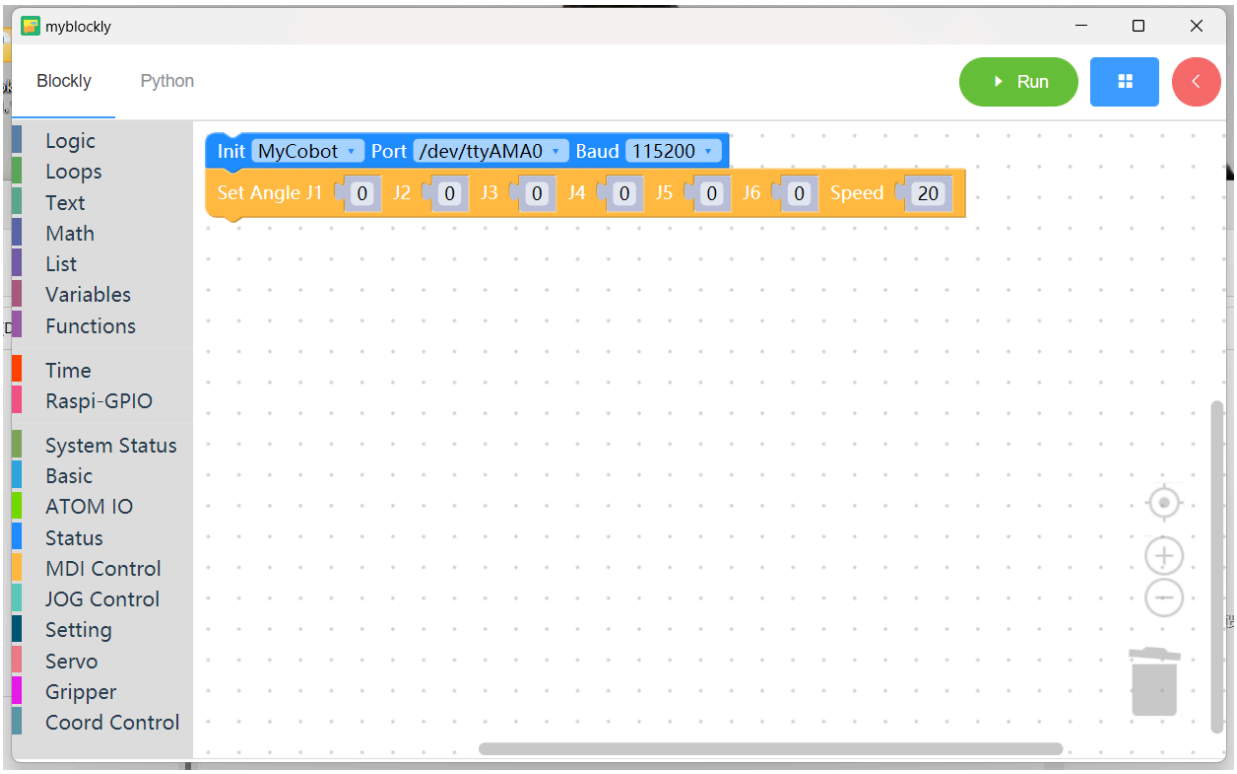
- Scope of application: This module is applicable to the 4-axis myPalletizer series
- Parameter introduction:

This module has two parameters that can be adjusted:

- Joint angle parameters: If the robot arm is returned to the origin, all joint angle parameters must be set to 0
- Speed parameters: Please refer to the robot parameter introduction section of **Product Introduction**
- Purpose: Control the robot arm and return the angles of all axes of the robot arm to the origin (angle is 0)

myCobot

Simple demonstration



- Implementation content: Control the robot arm to move back to the origin, so that the angles of all axes of the robot arm are 0

Control single joint motion

Preparation before starting

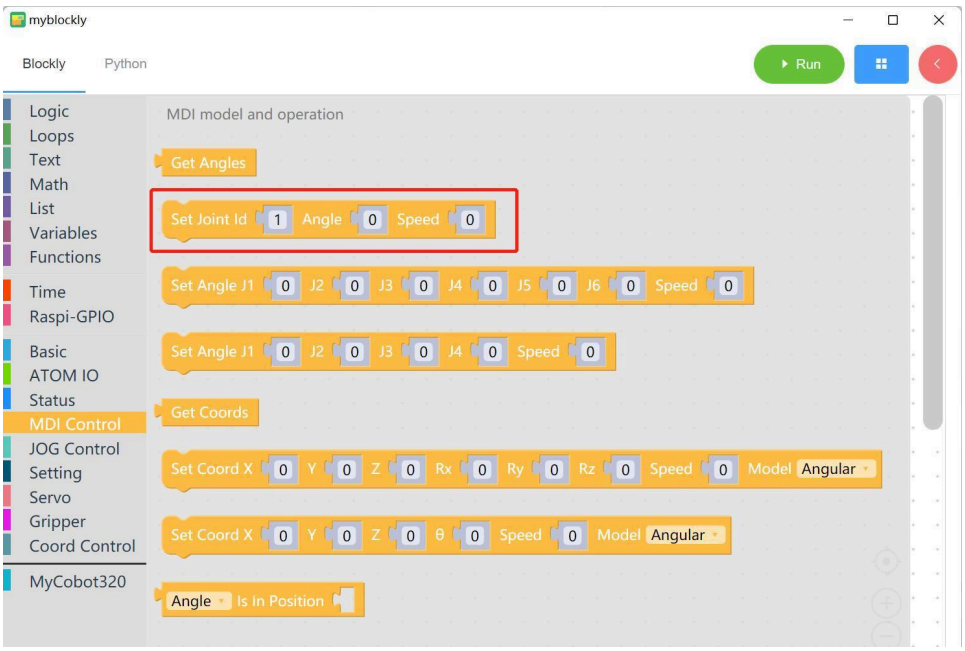
Other series: Make sure the machine is normal

Learning content in this chapter

How to use myBlockly to control the single joint motion of the robot

API introduction

- Method module: `Set joint`



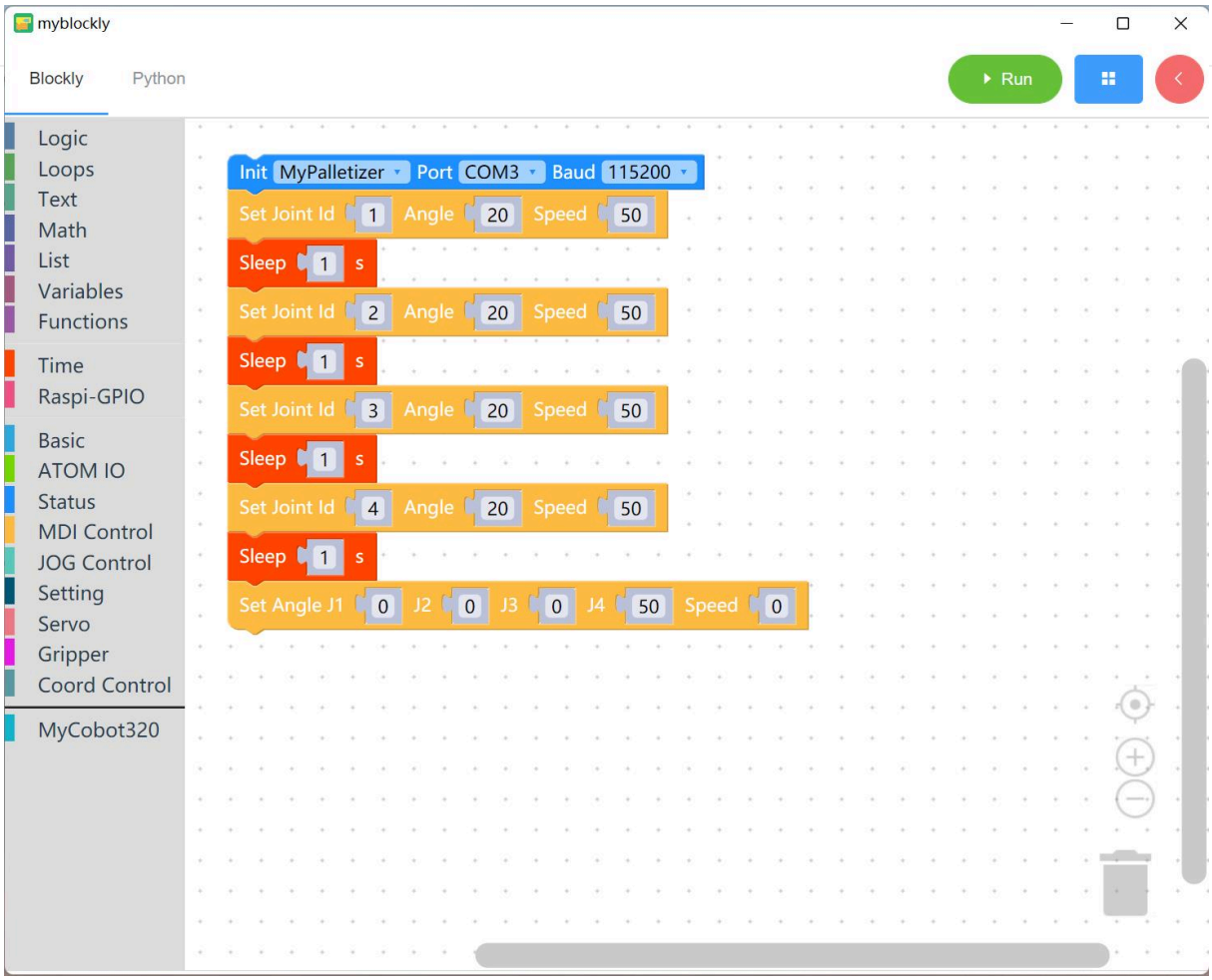
- Applicable scope: myCobot280 series, myCobot320 series, mechArm series, myPalletizer series
- Parameter introduction:

This method has three parameters that can be adjusted:

- Joint parameters: The parameter range of myCobot280 series, myCobot320 series and mechArm series is: 1-6; the parameter range of myPalletizer series is: 1-4 (corresponding to the joints of the robot arm)
- Angle parameters: refer to the parameters of the corresponding model
- Speed: Control the speed of the robot arm movement, the parameter range is: 0~100
- Purpose: Control the movement of a single joint of the robot arm

Simple demonstration

- The graphic code is as follows:



- Implementation content:

Control the robot arm 1 joint, run to the position of 1 joint angle 20 at a speed of 50, after one second,

Control the robot arm 2 joint, run to the position of 2 joint angle 20 at a speed of 50, after one second,

Control the robot arm 3 joint, run to the position of 3 joint angle 20 at a speed of 50, after one second,

Control the robot arm 4 joint, run to the position of 4 joint angle 20 at a speed of 50, after one second,

Return all joints of the robot arm to the origin at a speed of 60, and end the program.

Control multiple joints

Preparation before starting

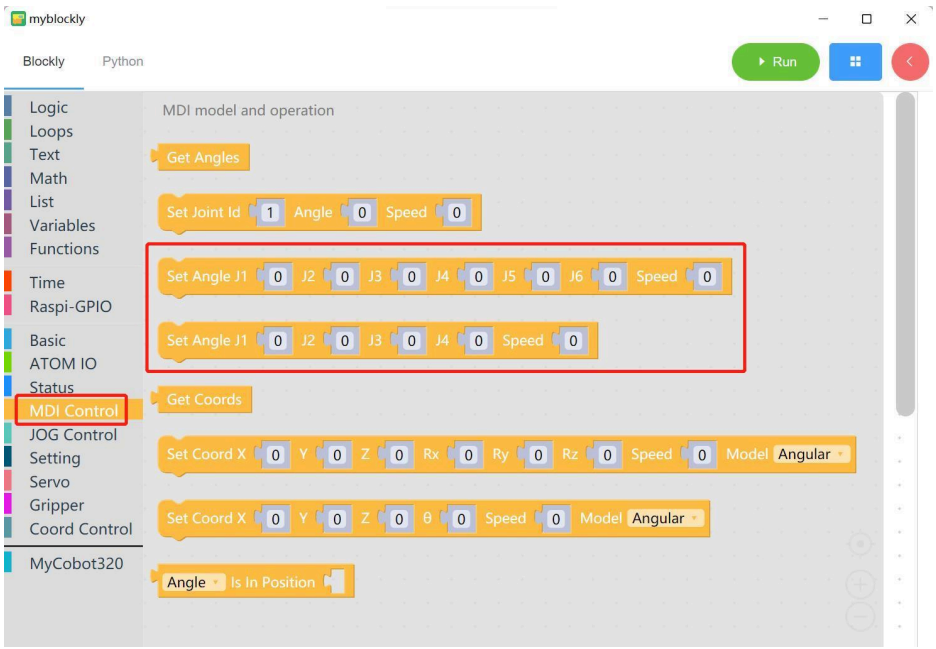
Other series: Make sure the machine is normal

Learning content in this chapter

How to use myBlockly to control the movement of multiple joints of the robot

API introduction

- Method module: `Set full angle`



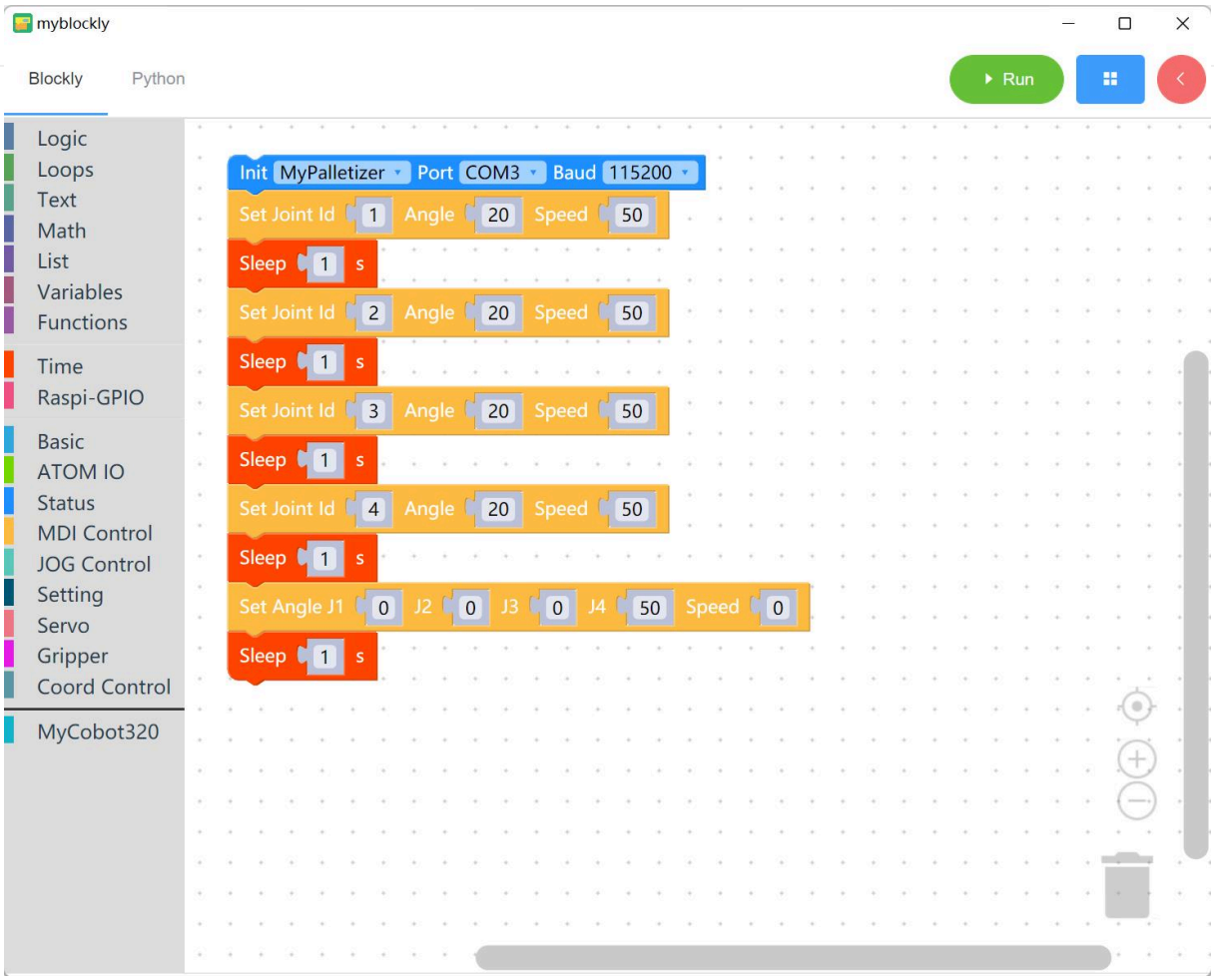
- Scope of application: This module is applicable to the 6-axis myCobot 280 series, mechArm series, myCobot 320 series
- Parameter introduction:

This module has two parameters that can be adjusted:

- Joint angle parameters: You can set the parameters within the range of joint motion of the robot arm as needed (for details of the joint motion range, please refer to **Product Introduction** scetion.
- Speed parameters: You can set the parameters within the range of robot arm motion speed as needed (for the maximum motion speed, please refer to **Product Introduction** scetion.
- Purpose: Control the motion of multiple joints of the robot arm

Simple demonstration

- The graphic code is as follows:



- Implementation content:

Control all joints of the robot to return to the origin. After two seconds,

Control joints 1, 2, 3 and 4 of the robot to run at a speed of 50 to 30 degrees, 30 degrees, -30 degrees and 50 degrees respectively. After two seconds,

Control all joints of the robot to return to the origin at a speed of 50. After two seconds,

Control joints 1, 2, 3 and 4 of the robot to run at a speed of 50 to -30 degrees, 0 degrees, 30 degrees and -50 degrees respectively. After two seconds, end the program.

Control the robot arm to swing left and right

Preparation before starting

M5Stack series: Make sure the robot arm is connected to the computer

Other series: Make sure the machine is normal

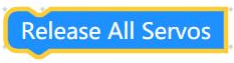
Learning content in this chapter

How to use myBlockly to control the robot arm to swing left and right

API display

- Method module **1**: `Power on`

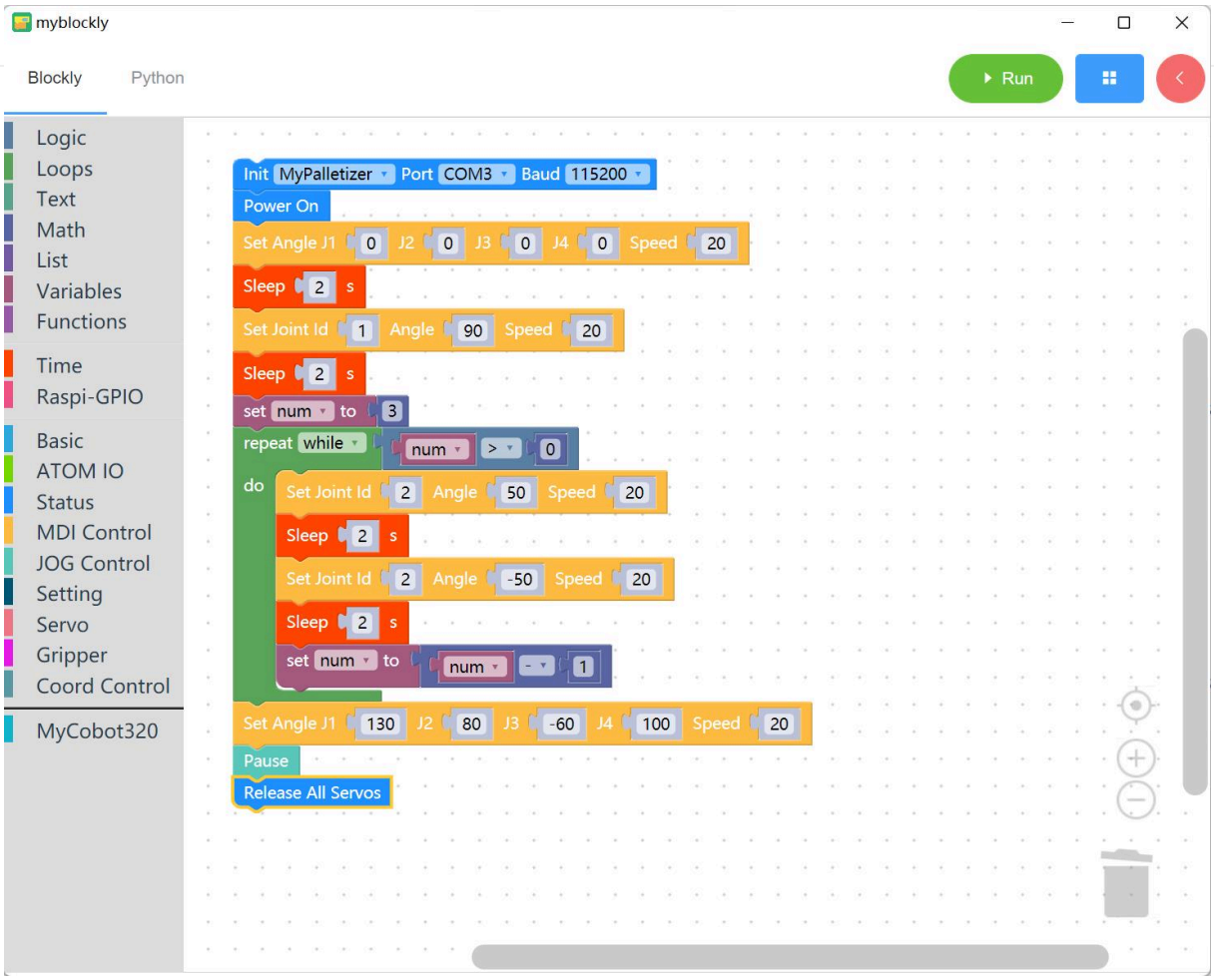
- Applicable scope: myCobot280 series, myCobot320 series, mechArm series, myPalletizer series
- Purpose: Start the system
- Method module **2**: `Release joints`



- Applicable scope: myCobot280 series, myCobot320 series, mechArm series, myPalletizer series
- Purpose: Stop the movement of the robot arm and lock each joint

Simple demonstration

- The graphic code is as follows:



- Implementation content:

Power on the robot arm and control the robot arm to move back to the origin. After two seconds,

Control the robot arm 1 joint to run to the angle 50 position at a speed of 20. After two seconds,

Control the robot arm 2 joint to run to the angle 20 position at a speed of 20. After two seconds,

Control the robot arm 2 joint again to run to the angle -50 position at a speed of 20. After two seconds,

Loop the control of the 2 joints twice. After the loop ends,

Run the 1st joint, 2nd joint, 3rd joint and 4th joint at a speed of 20 to the angles of 130, 80, -60 and 100 respectively.

Finally, the robot arm movement is paused, all joints are released, and the program ends.

Control the robot to dance

Preparation before starting

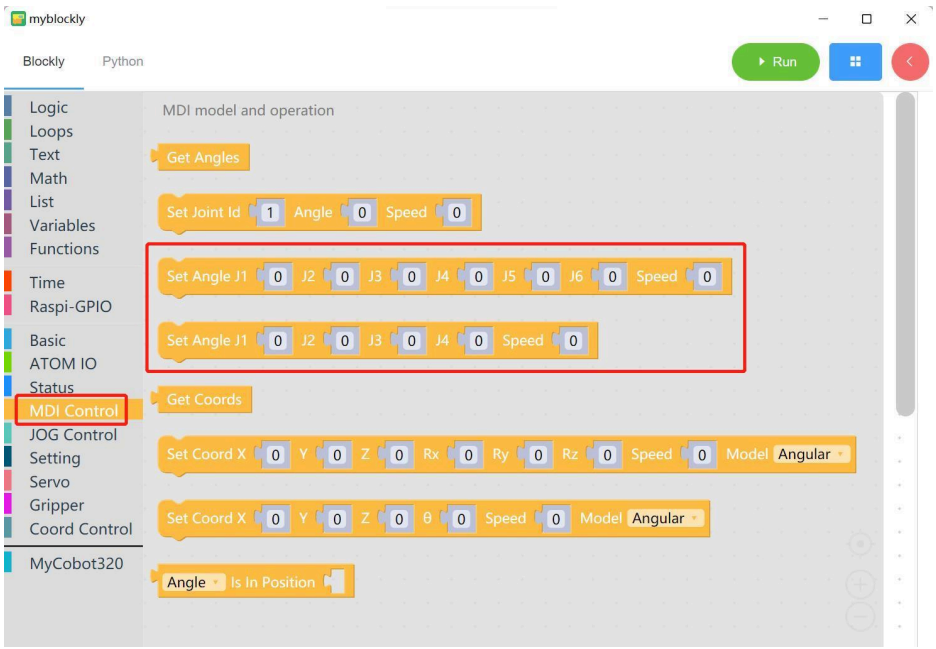
Other series: Make sure the machine is normal

Learning content in this chapter:

How to use myBlockly to control the robot to dance

API display

- Method module: `Set full angle`



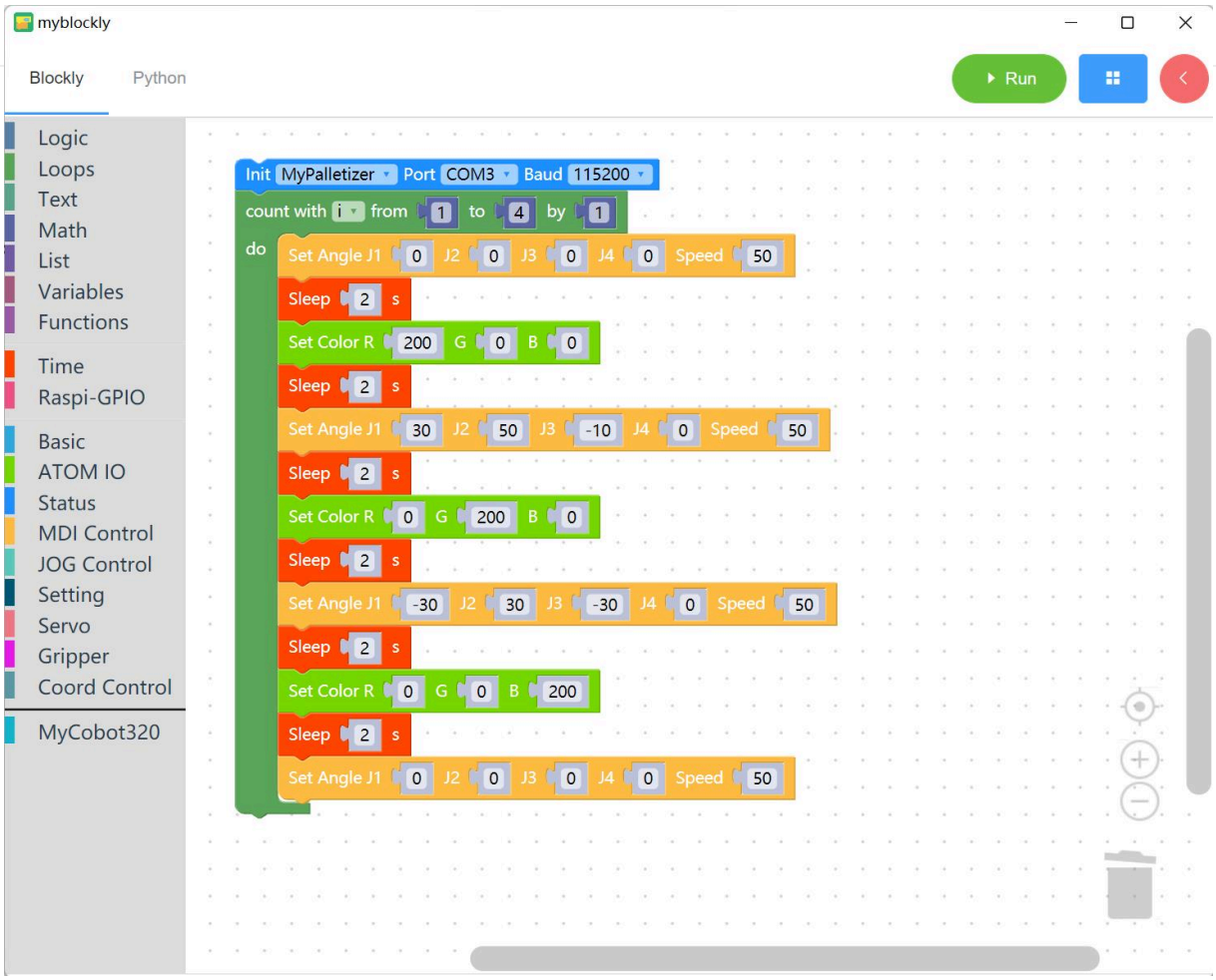
- Scope of application: This module is suitable for 6-axis myCobot 280 series, mechArm series, myCobot 320 series
- Parameter introduction:

This module has two parameters that can be adjusted:

- Joint angle parameters: You can set the parameters within the range of joint motion of the robot arm as needed (for details of the joint motion range, please refer to Product Introduction section.
- Speed parameters: You can set the parameters within the range of robot arm motion speed as needed (for the maximum motion speed, please refer to Product Introduction section.
- Purpose: Control the motion of multiple joints of the robot arm

Simple demonstration

- The graphic code is as follows:



- Implementation content:

Control all joints of the robot arm to return to their original positions, and the RGB light board turns red.

After one second, control joints 1, 2, and 3 to run at a speed of 50 to 30 degrees, 50 degrees, and -10 degrees respectively.

After one second, the RGB light board turns green.

After one second, control joints 1, 2, and 3 to run at a speed of 50 to -30 degrees, 30 degrees, and -30 degrees respectively.

After one second, the RGB light board turns blue.

After one second, control all the robot arms to shut down and return to their original positions.

Use of grippers

Preparation before starting

Other series: Make sure the machine is normal

Grippers include adaptive grippers, electric grippers, and pneumatic grippers. Different grippers are compatible with different robot arm models. For details, please refer to **Accessories**. Here, we take the adaptive gripper and myPalletizer 260 M5Stack robot arm as an example to explain how to use myBlockly to control the gripper.

Learning content in this chapter

How to use myBlockly to control the adaptive gripper connected to the myPalletizer 260 M5Stack robot

API display

- Method module **1**: `Reinitialize the gripper`

- Applicable scope: myCobot 280 series, myPalletizer 260 series, mechArm 270 series
- Purpose: Set the initial position of the gripper
- Method module **2**: `Set the gripper state`

- Applicable scope: myCobot 280 series, myPalletizer 260 series, mechArm 270 series
- Parameter introduction:

This module has two parameters that can be adjusted:

- Gripper state parameter: 1 indicates the gripper is closed, 0 indicates the gripper is open
- Speed parameter: indicates the speed of rotation, the value range is 0~100
- Purpose: Make the gripper enter the specified state (open or closed) at the specified speed
- Method module **3**: `Set the value of the gripper`

- Applicable scope: myCobot 280 series, myPalletizer 260 series, mechArm 270 series
- Parameter introduction:

This module has two parameters that can be adjusted:

- Gripper value parameter: indicates the position to be reached by the gripper, with a value range of 0~256.
- Speed parameter: indicates the speed of rotation, with a value range of 0~100.

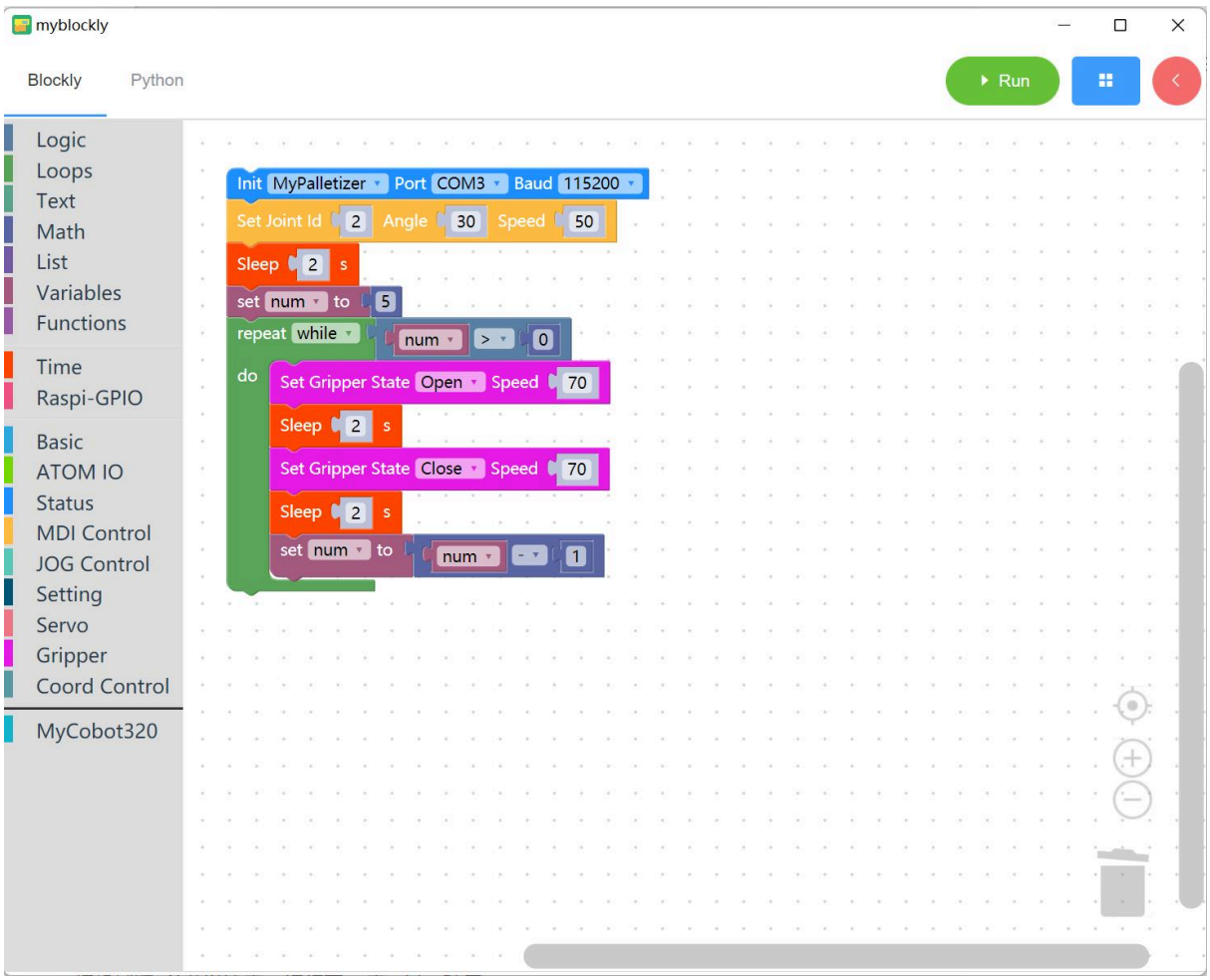
- Purpose: Make the gripper rotate to the specified position at a specified speed.

- Method module **4**: `Is the gripper moving`

- Applicable scope: myCobot 280 series, myPalletizer 260 series, mechArm 270 series
- Purpose: Determine whether the gripper is running

Simple demonstration

- The graphic code is as follows:



- Implementation content:

The robot arm 2 joint runs at a speed of 50 to 30 degrees. After one second,

the gripper opens at a speed of 70. After one second,

the gripper closes at a speed of 70.

After the gripper opens and closes 5 times, the program ends.

Use of suction pump

Preparation before starting

M5Stack series: Make sure the robot is connected to the computer (

Other series: Make sure the machine is normal

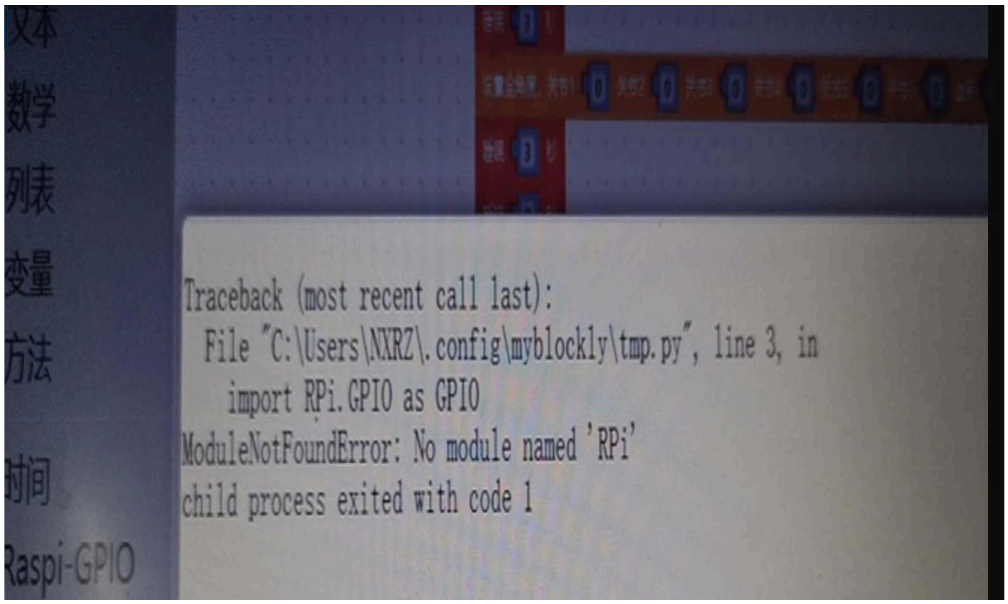
For the introduction and installation of the suction pump, please refer to **Accessories**. The robot models that are compatible with the suction pump include myCobot 280, myPalletizer 260 and mechArm 270. Here, the myPalletizer 260 M5Stack robot is used as an example.

Learning content in this chapter

How to use myBlockly to control the suction pump connected to the myPalletizer 260 M5Stack robot

API display

Note: The M5 version and the Raspberry Pi version require different method modules to control the suction pump. The M5 version robot cannot use the Raspberry Pi interface. If the module does not match the model, the program will report an error (as shown below).



- Method module **1**(for Raspberry Pi version): `Set Mode`

- Applicable to: Raspberry Pi versions of myCobot 280 series, myPalletizer 260 series and mechArm 270 series
- Parameter introduction:
- Mode parameter: can enter "BCM" or "BOARD" mode
- Purpose: Set the Raspberry Pi GPIO pin mode

- Method module **2** (Raspberry Pi version): `Pin signal setting`

- Applicable to: Raspberry Pi versions of myCobot 280 series, myPalletizer 260 series and mechArm 270 series
- Parameter introduction:

This module has two parameters that can be adjusted:

- Pin number: The specific pin number at the bottom of the device (only the digital part is taken)
- Level status: IN is set to input signal, OUT is set to output signal
- Purpose: Set pin signal
- Method module **3** (Raspberry Pi version): `Pin level setting`

- Applicable scope: Raspberry Pi version of myCobot 280 series, myPalletizer 260 series and mechArm 270 series
- Parameter introduction:

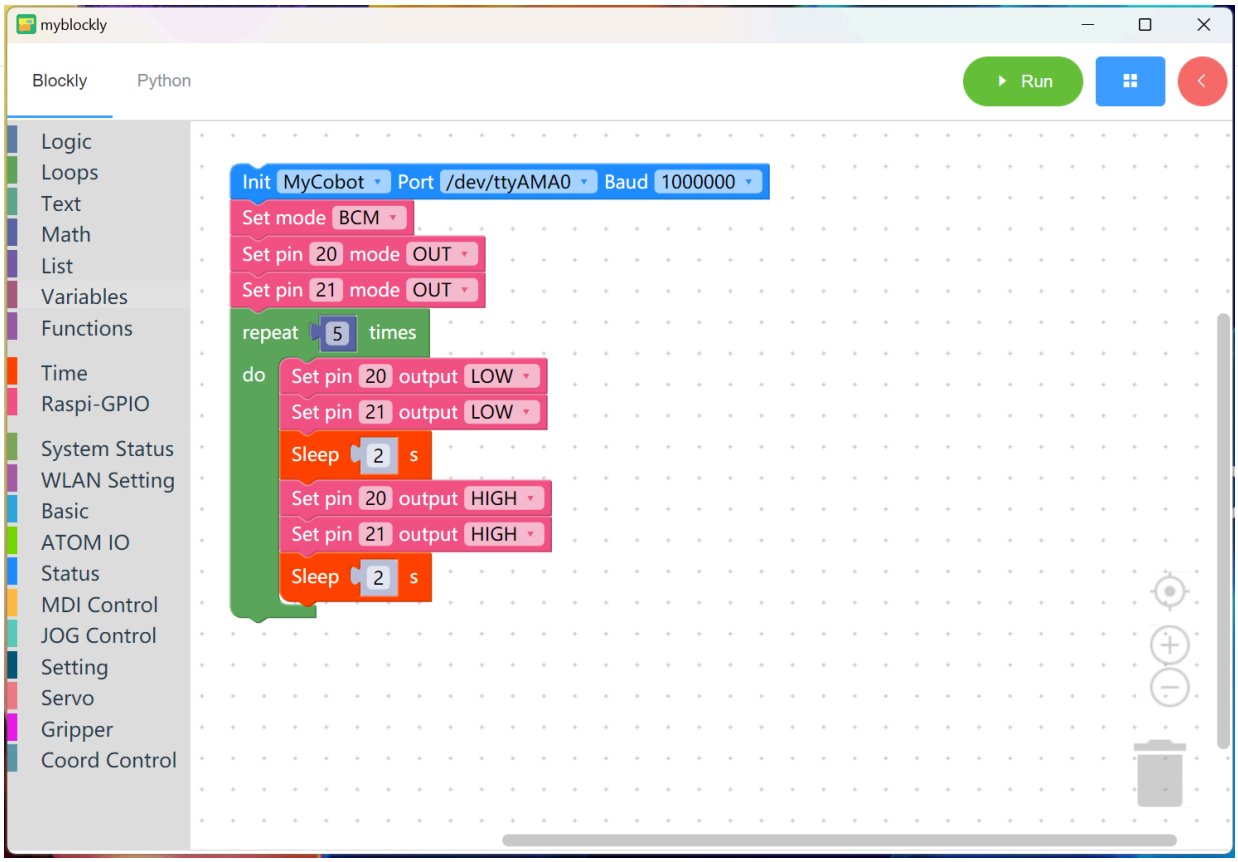
This module has two parameters that can be adjusted:

- Pin number: the specific pin number at the bottom of the device (only the digital part is taken)
- Level state: 0 is set to low level, 1 is set to high level (low level of suction pump starts working, high level stops working)
- Purpose: Set the pin to high or low level

Simple demonstration

Vertical suction pump V1.0

- The graphic code is as follows: (for M5 version)

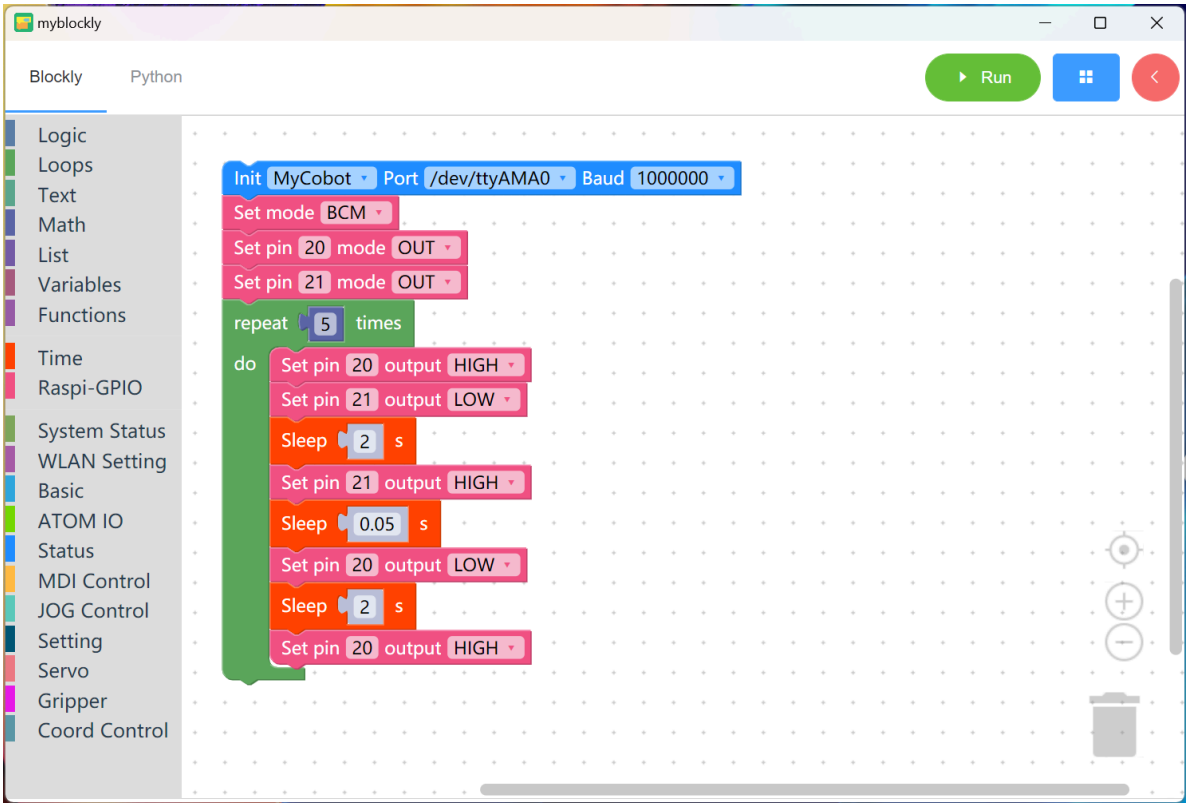


- Graphic code is as follows: (for Raspberry Pi version)

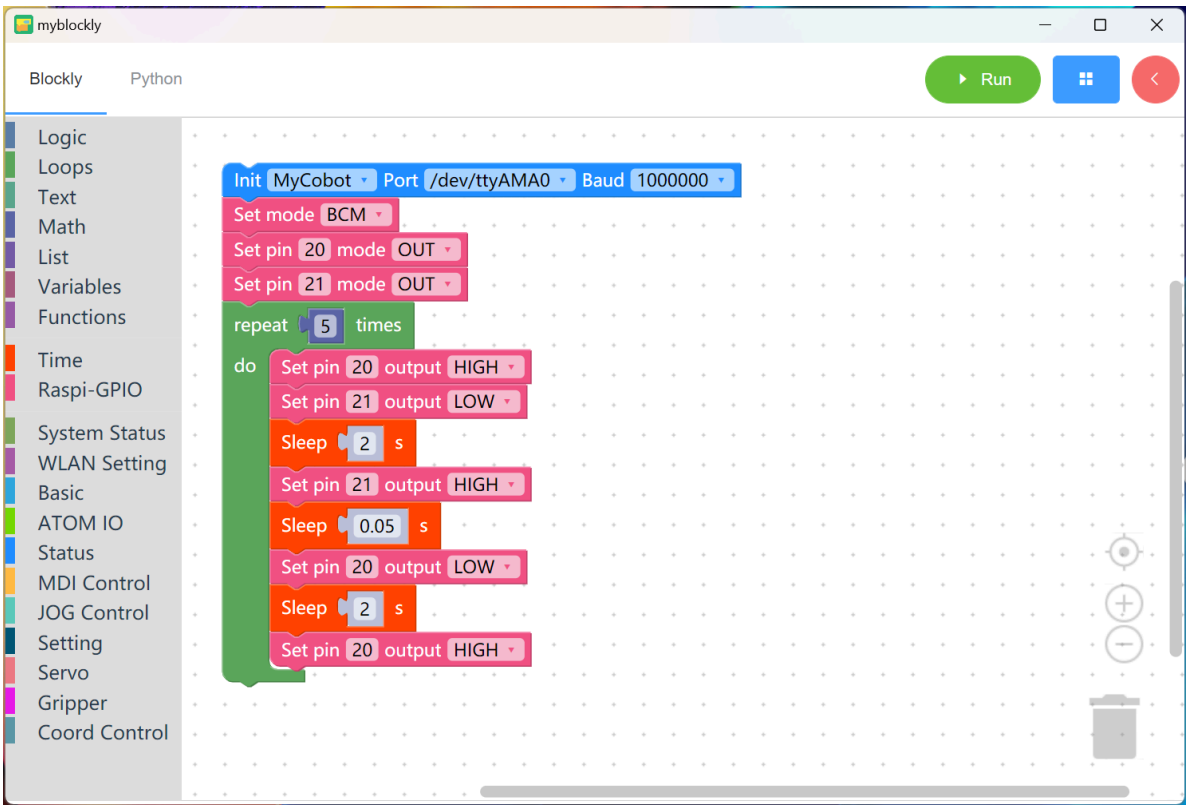
- Implementation content: The suction pump vibrates and starts working. The suction pump sucks up the object, puts it down after two seconds, and repeats the previous action after another two seconds until the program runs to the end.

Vertical Suction Pump V2.0

- Graphic code is as follows: (for M5 version)
- Pin 5/2 controls the solenoid valve and the air release valve respectively



- Graphic code is as follows: (for Raspberry Pi version)
- Pin 20/21 controls the solenoid valve and the air release valve respectively



- Implementation content: First close the solenoid valve and open the air release valve to prepare for starting the suction pump; after two seconds, close the air release valve. After 0.05 seconds, open the solenoid valve, the suction pump vibrates and starts working. The suction pump picks up the object and puts it down after two seconds. Close the air release valve and repeat the previous actions until the program ends.

Gripper test

Before you start

M5Stack series: Make sure the robot arm is connected to the computer

Others: Make sure the machine is normal

To use the gripper test function, myblockly needs to be updated to v3.3.5

Learning content in this chapter

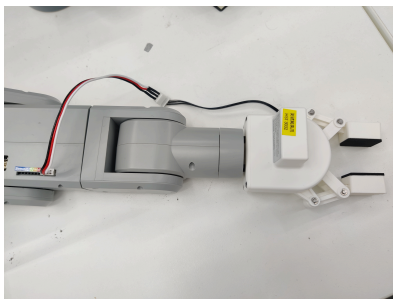
How to use myBlockly to quickly test whether the gripper is normal.

Currently, the gripper test function is only compatible with the following models: myCobot 280 series, mecharm 270 series, myPalletizer 260 series, myArm 300 Pi.

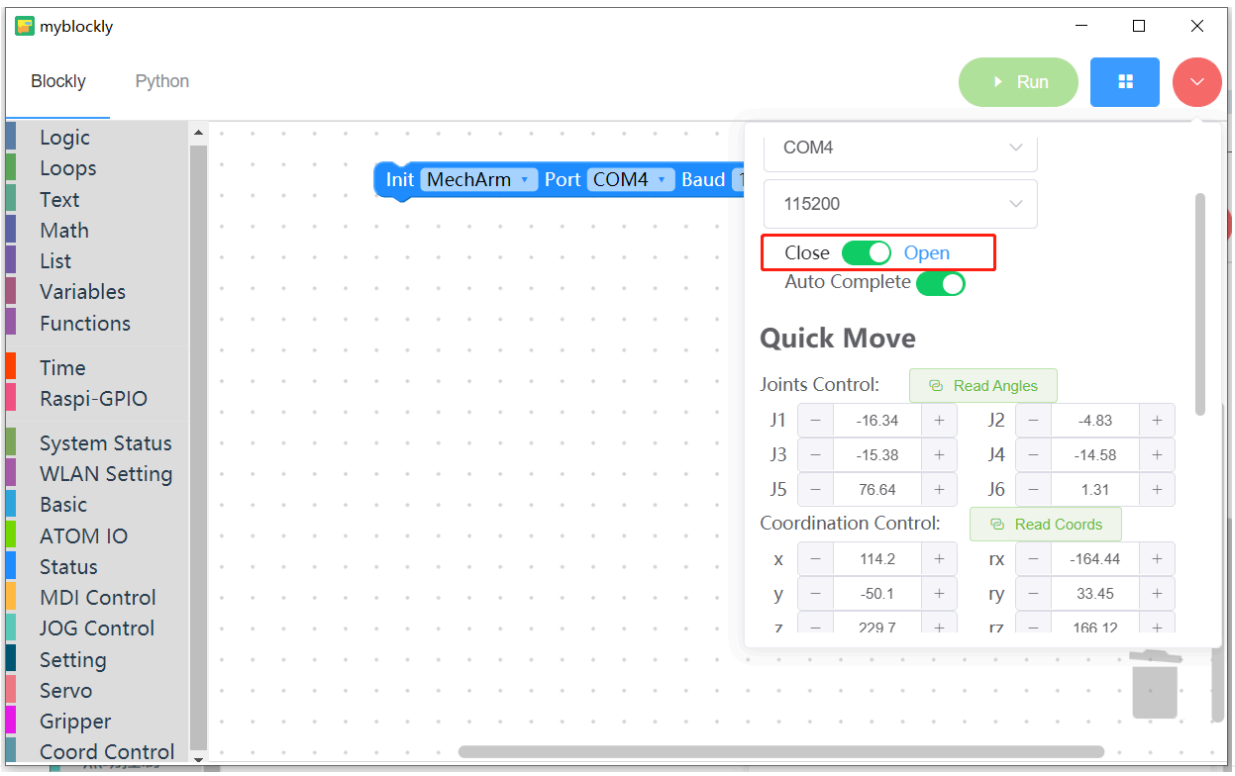
Gripper includes adaptive gripper, electric gripper and pneumatic gripper. Different grippers are compatible with different robot arm models. For details, please refer to **Accessories**.

Here, mecharm 270 M5 and adaptive gripper are used as an example.

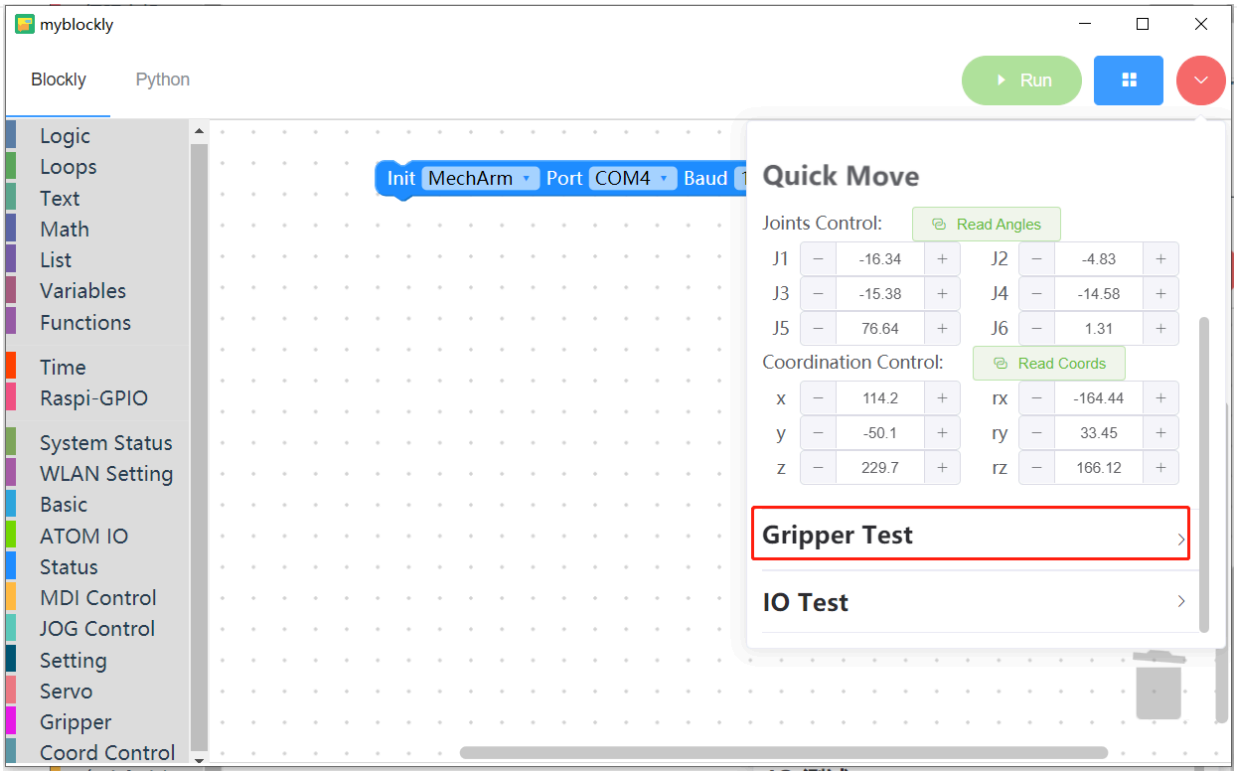
First install the gripper on the machine



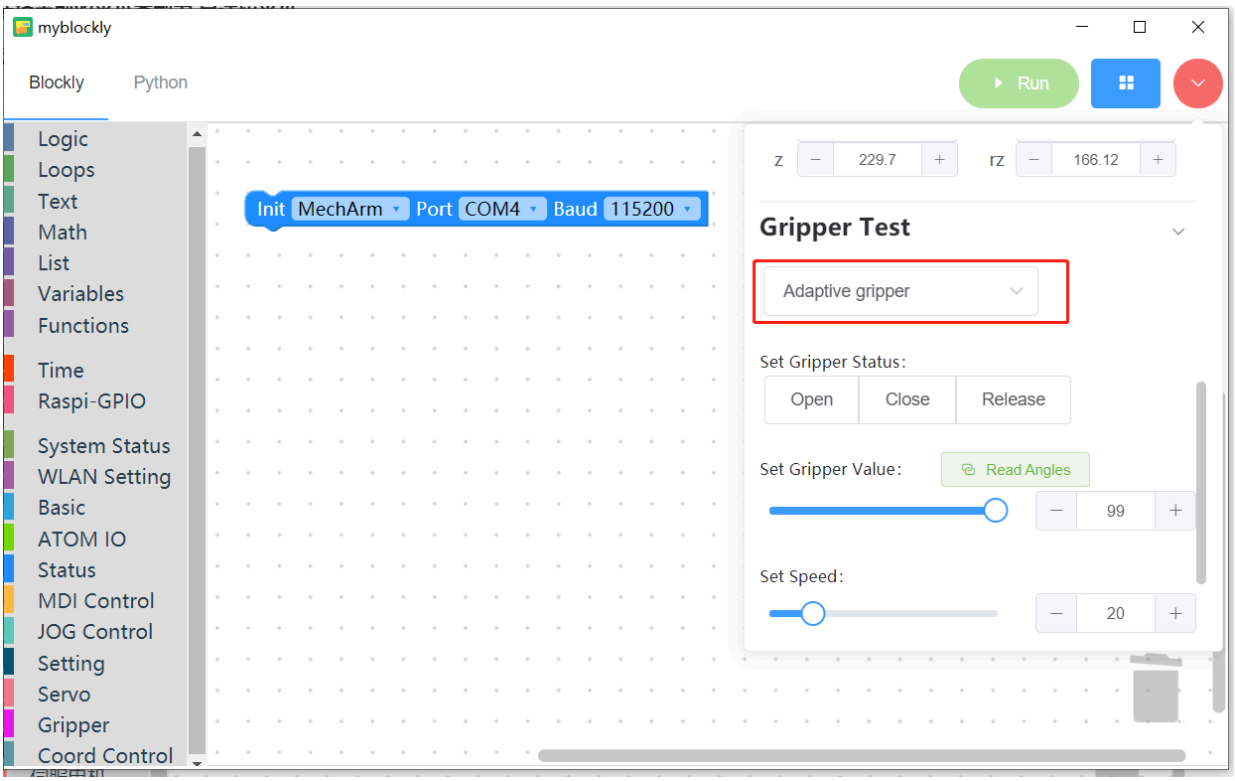
myblockly connects to the machine serial port



Open the gripper test



Select the current gripper type as Adaptive Girpper



Then you can try the following operations:

- Set the gripper state: open, closed, released. Pay attention to the movement of the gripper.
- Click the Read Angle button to get the current gripper value.
- You can fine-tune the gripper value.

- You can set the gripper's moving speed.

> Tips: When the gripper type is Dexterous Hand, you cannot set the gripper value, you can only set its status.

IO test

Preparation before starting

Others: Make sure the machine is normal

To use the IO test function, myblockly needs to be updated to v3.3.5

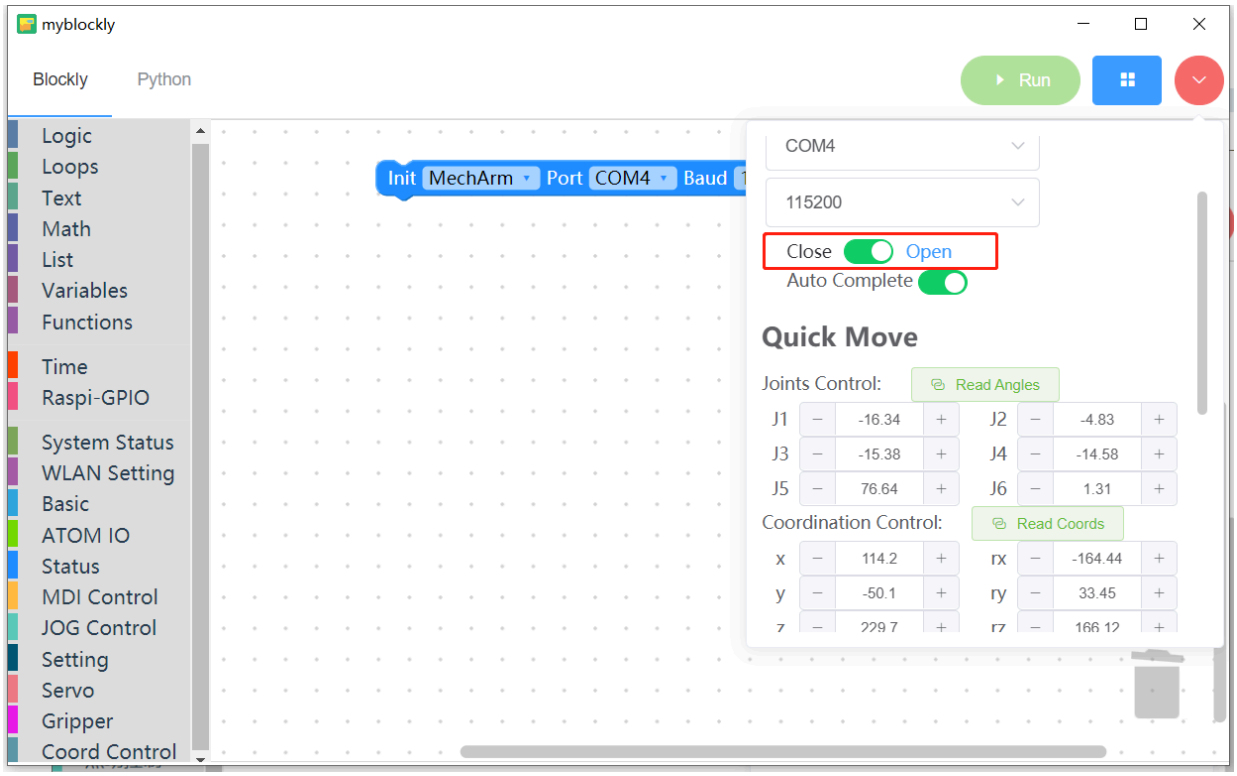
Learning content in this chapter

How to use myBlockly to quickly test whether io is normal.

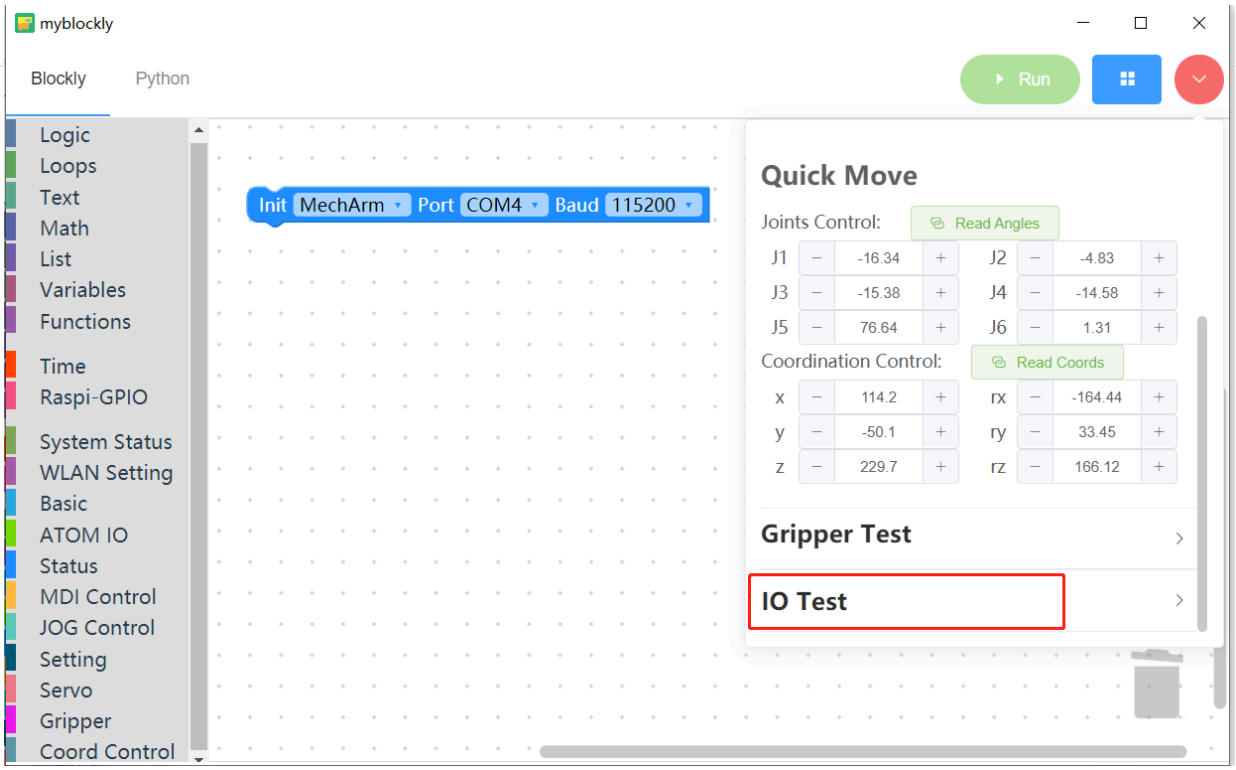
Currently, the gripper test function is only compatible with the following models: myCobot 280 series, mecharm 270 series, myPalletizer 260 series, myArm 300 Pi.

Here, take mecharm 270 M5 as an example.

myblockly connects to the machine serial port

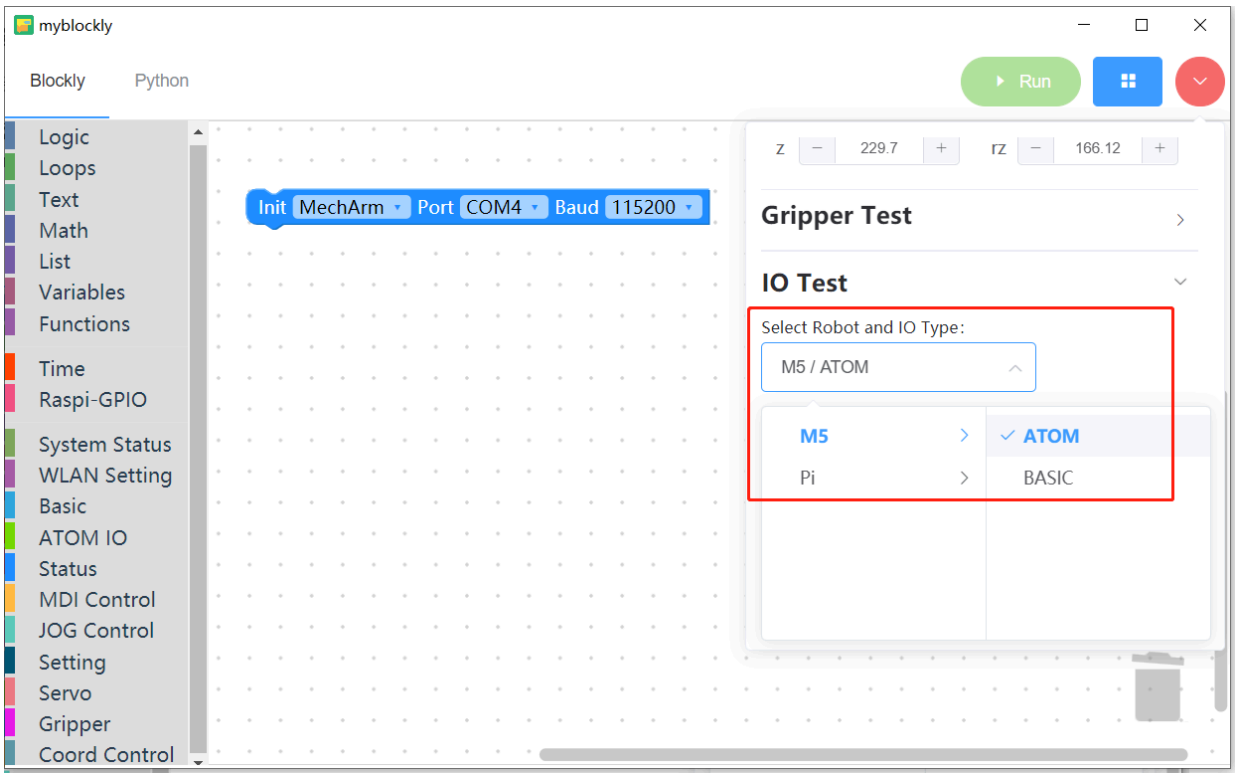


Open IO test



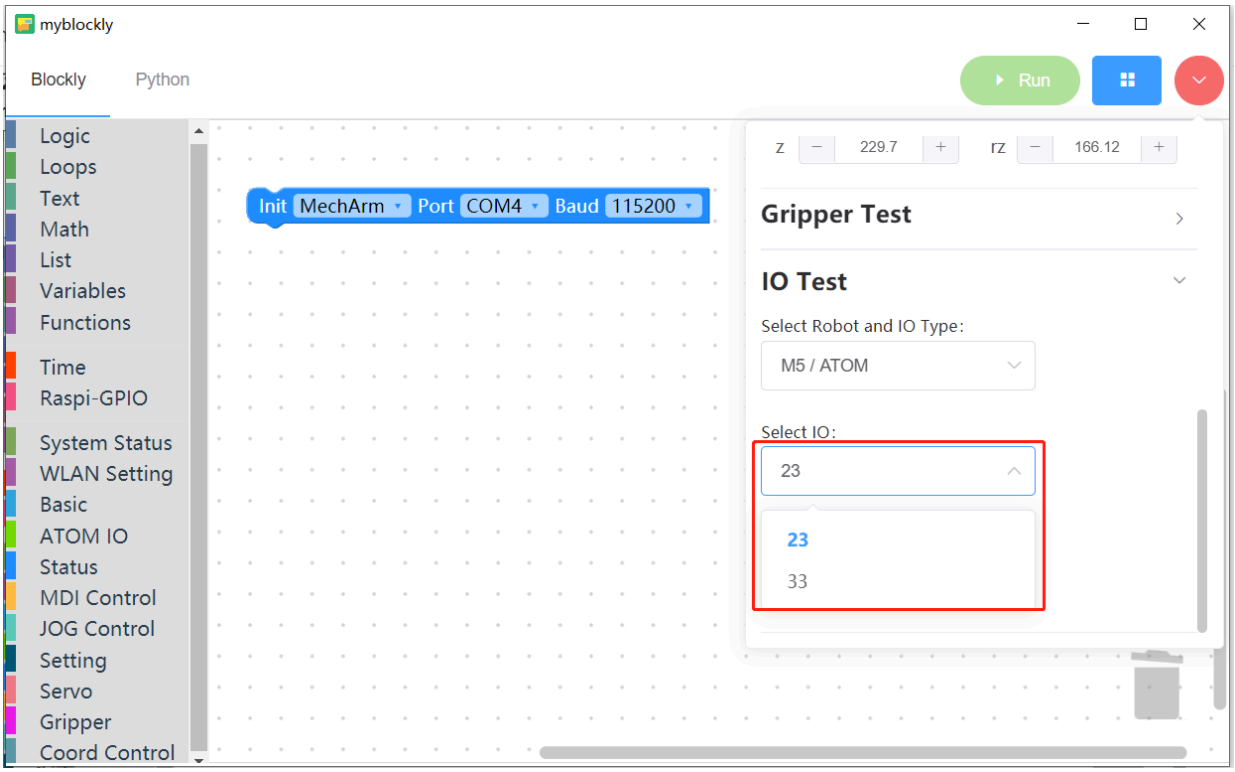
Select IO type

Our current model is M5, so select M5 type. You can choose ATOM and BASIC in the M5 category. Here we choose ATOM



Select ATOM IO

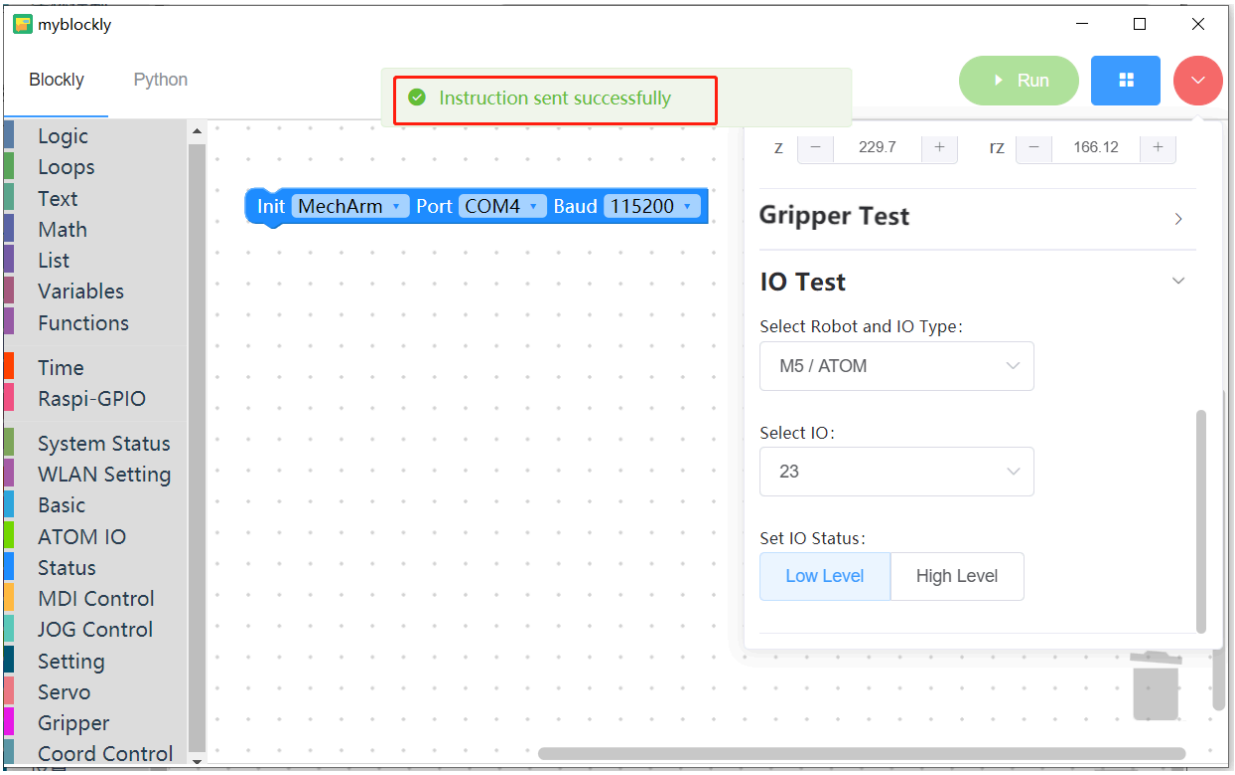
meacharm 270 M5 Atom IO ports are currently only open 23 and 33



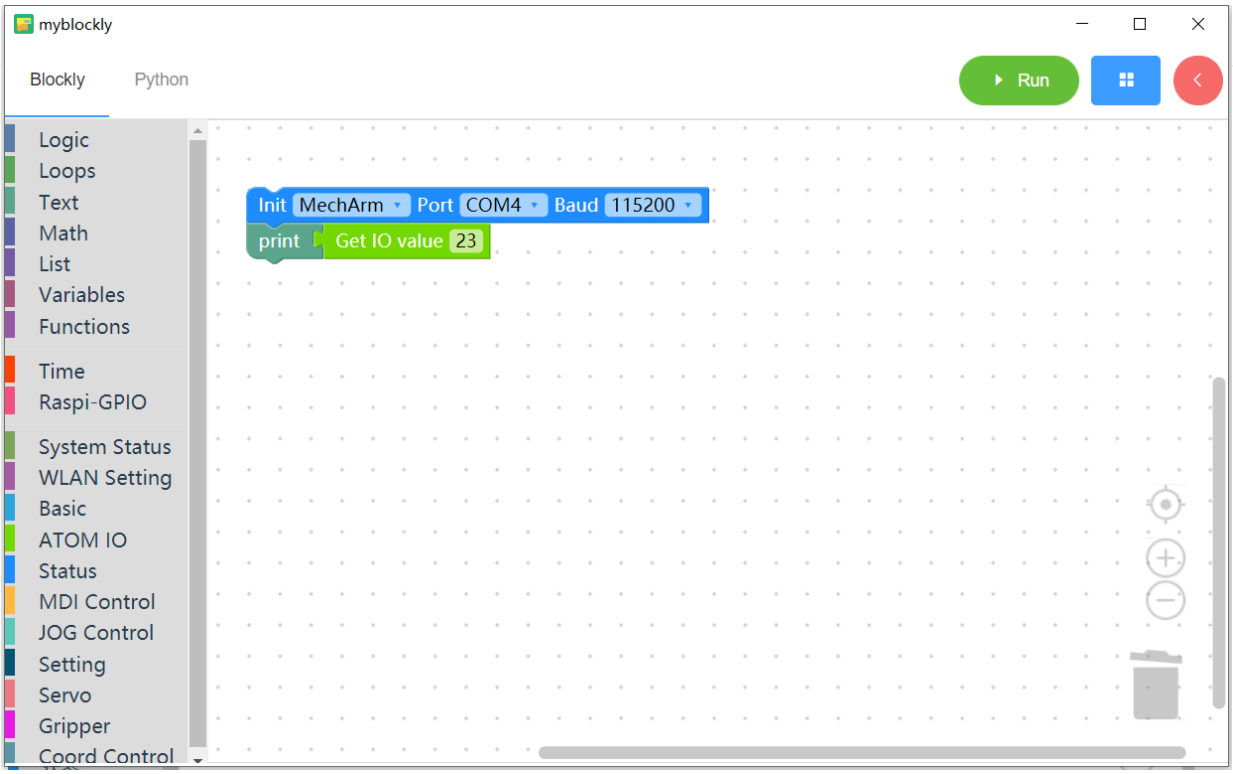
Operate IO status

You can click the `Low Level` `High Level` buttons to change the current selection io port status

Set high and low levels and send the command successfully



After changing the io status, you can read the Atom io high and low levels through the building block to check whether it is successful


myblockly
Blockly
Python
Run
Logic
Loops
Text
Math
List
Variables
Functions
Time
Raspi-GPIO
System Status
WLAN Setting
Basic
ATOM IO
Status
MDI Control
JOG Control
Setting
Servo
Gripper
Coord Control
Init MechArm Port COM4 Baud 115200
print Get IO value 23

Q&A

This chapter lists common problems in using myBlockly to control the robot arm for reference.

Q1: myBlockly reports an error `ModuleNotFoundError: No module named 'pymycobot'` when running

A: This is because the pymycobot library is not installed when setting up the Python environment. To install the pymycobot library, open the terminal (Win key + R key), enter: `pip install pymycobot --upgrade --user`, and press Enter to display Successfully installed pymycobot.

Q2: The robot arm is unresponsive due to the lack of a `sleep` method module

A: The program that operates the robot arm movement takes time to complete, so a `sleep` module needs to be connected after an action to give the robot arm time to move before the next movement (the required time depends on the situation, and the robot arm is set by default to run myBlockly with a minimum sleep time of no less than 0.5s), otherwise the robot arm will not be able to achieve the desired movement.

Q3: The `Run` button in the upper right corner cannot be clicked, and it is gray-green.

A: The new version of myBlockly has added the function of detecting the serial communication of the robot arm. If the robot arm is currently connected to the computer, you need to check:

(1) Is there a background program occupying the robot arm's serial port?

(2) Is the toolbar under the red arrow on the right closed? If it is open, you need to manually close it.

Q4: Why do I get a lot of errors after running the program?

A: Before running the program, you need to confirm a few points:

(1) Please make sure that your robot arm's serial port number and baud rate are correct.

How to check the serial port number:

- In Windows, find the device manager and check the port.

If the port (COM and LPT) shows USB-Enhanced-SERIAL CH9102, it is a CP34X chip.

If the port (COM and LPT) shows Silicon Labs CP210x USB to UART Bridge, it is a CP210X chip. The ports with these two names are the serial port numbers of your robot arm.

- In Linux, open the terminal and enter ls/dev/tty* and press Enter. The serial port number of the robot arm is displayed. AMA0 or USB0 is the serial port number of your robot arm.
- Open the terminal on Mac, enter cd /dev/ and press Enter, then ls -al tty to find it, for example /dev/tty.usbserial-10.

(2) Please make sure the baud rate is correct. The baud rates of M5, myCobot 320 Pi-2020, myCobot 320 Pi-2022, myCobot 280 Jetson nano, and myCobot 280 Arudino are all 115200. The baud rates of myCobot 280 Pi, myPalletizer 260 Pi, mecahrm 270 Pi, myBuddy 280, Pro 600, etc. are all 1000000.

(3) Please make sure that the model, serial port number, and baud rate in the blue box are consistent with those in the small toolbar on the right, and match the robot arm.

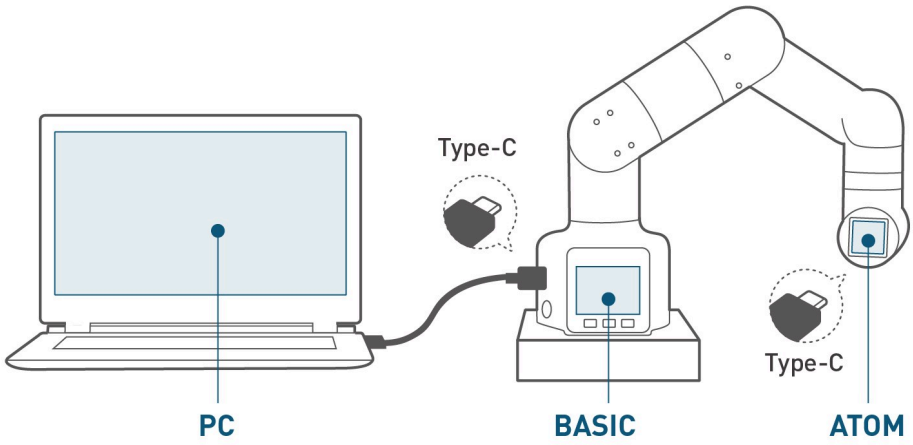
Q5: Error MyCobot.*int*() takes 2 positional arguments but 3 were given.

A: This error will appear in the old version of myBlockly because the versions of myBlockly and pymycobot do not match. Just update the versions of myBlockly and pymycobot driver library.

Q6: The result of running the program shows child process exited with code 1 A: This is not an error. All programs have finished running and returned the binary number 1. It means that everything has been successfully completed.

Communication and message commands

Note: To use the communication protocol for direct communication, you need to burn transponder in basic and the latest version of atomMain in atom



Robotic arm motion parameters

Joint	*Joint minimum value °	Joint maximum value °	Joint maximum speed °/s	Joint maximum acceleration °/s²
J1	-168	168	150	200
J2	-135	135	150	200
J3	-150	150	150	200
J4	-145	145	150	200
J5	-165	165	150	200
J6	-180	180	150	200

Axis	*Minimum value of coordinate mm	Maximum value of coordinate mm	Maximum velocity of coordinate mm/s	Maximum acceleration of coordinate mm/s²
x	-281.45	281.45	100	400
y	-281.45	281.45	100	400
z	-70	412.76	100	400
rx	-180°	180°	40°	66°/s²
ry	-180°	180°	40°	66°/s²
rz	-180°	180°	40°	66°/s²

USB Communication Settings

Please make sure your communication settings are as follows

- Bus interface: USB Type-C connection
- Baud rate: 115200
- Data bits: 8
- Parity: None
- Stop bits: 1

Command frame description and single command analysis

The host Basic sends data to the slave, and the slave parses the data after receiving it. If the command contains a return value, the slave will return it to the host within 500ms.

Command frame sending and receiving format

All commands are in hexadecimal, and the sending and receiving formats are consistent.

Each communication command must contain the following 5 parts, of which 3 and 4 can be empty.

- 1 **Command header**: 0xFE 0xFE
- Fixed
- Required
- 2 **Effective command length**: 0x02 ~ 0x10
- Length of all the following commands
- Required
- 3 **Command number**: 00 ~ 8F
- Multiple commands have been developed
- Can be empty
- 4 **Command content**: Several
- Can be empty
- 5 **Command end**: 0XFA
- Fixed
- Required

Command parsing

The host Basic sends data to the slave, and the slave parses the data after receiving it. If the command contains a return value, the slave will return it to the host within 500ms.

Type	Data description	Data length	Description
Command frame	Header byte 0	1	Frame header identification, 0XFE
	Header byte 1	1	Frame header identification, 0XFE
	Data length byte	1	Different instructions correspond to different lengths of data
	Command byte	1	Depends on different commands
Data frame	Data	0-16	Data attached to the command, depending on different commands
End frame	End byte	1	Stop bit, 0XFA

Single command analysis

Robot power on

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X10
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 10 FA

No return value

Robotic arm power off and disconnect

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X11
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 11 FA

No return value

Atom status query

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X12
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 12 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return command frame	0X12
Data[4]	Power on/off	0X01/0X00
Data[5]	End frame	0XFA

Assume that Atom is powered on

Serial port return example: FE FE 03 12 01 FA

Robotic arm only powers off

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X13
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 13 FA

No return value

Robot system detection is normal

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X14
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 14 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return command frame	0X14
Data[4]	Normal connection/disconnection	0X01/0X00
Data[5]	End frame	0XFA

Assuming Atom connection is successful

Serial port return example: FE FE 03 14 01 FA

Command refresh mode switch (set interpolation/refresh motion mode)

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X16
Data[4]	Command frame	0X01/0X00
Data[5]	End frame	0XFA

Set to refresh motion mode:

Serial port sending example: FE FE 03 16 01 FA

Set to interpolation motion mode:

Serial port sending example: FE FE 03 16 00 FA

Robot free mode (turn off all torque output)

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X1A
Data[4]	Open/Close	01/00
Data[5]	End frame	0XFA

Set to free movement mode:

Serial port sending example: FE FE 03 1A 01 FA

Check whether it is free mode

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X1B
Data[5]	End frame	0XFA

Serial port sending example: FE FE 02 1B FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return instruction frame	0X1B
Data[4]	Open/Close	0X01/0X00
Data[5]	End frame	0XFA

Assuming Atom is in free movement mode

Serial port return example: FE FE 03 1B 01 FA

Read angle (read movement information)

Data field	Description	Data
Data[0]	Identify frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X20
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 20 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X0E
Data[3]	Return command frame	0X20
Data[4]	No. 1 servo angle high	Angle1_high
Data[5]	No. 1 servo angle low	Angle1_low
Data[6]	Angle 2 high position	Angle2_high
Data[7]	Angle 2 low position	Angle2_low
Data[8]	Angle 3 high position	Angle3_high
Data[9]	Angle 3 low position	Angle3_low
Data[10]	Angle 4 high position	Angle4_high
Data[11]	Angle 4 low position	Angle4_low
Data[12]	Angle 5 high position	Angle5_high
Data[13]	Angle 5 low position	Angle5_low
Data[14]	Angle 6 high position	Angle6_high
Data[15]	Angle 6 low position	Angle6_low
Data[16]	End frame	0XFA

Serial port return example: FE FE 0E 20 00 8C 00 3D FF E6 FF 3F 00 AF FF 51 FA

How to get the angle of joint 1

temp = angle1_low+angle1_high*256

Angle1=（temp \ 33000 ?(temp – 65536) : temp）/100

Calculation method: angle value low + angle value high multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 100. If it is less than 33000, directly divide by 100

(The same applies to the rest)

Send a single angle

Data field	Description	Data
Data[0]	Identify frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X06
Data[3]	Command frame	0X21
Data[4]	Servo serial number	joint_no
Data[5]	Angle value high	angle_high
Data[6]	Angle value low	angle_low
Data[7]	Specified speed	sp
Data[8]	End frame	0XFA

Move servo No. 1 to zero position at 20% speed

Serial port sending example: FE FE 06 21 01 00 00 14 FA

joint_no value range: 1~6

angle_high: data type byte

Calculation method: multiply the angle value by 100 and convert it to int format first Then take the high byte of the hexadecimal

angle_low: data type byte

Calculation method: multiply the angle value by 100, convert it to int format, and then take the low byte of the hexadecimal

No return value

Send all angles

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X0F
Data[3]	Command frame	0X22
Data[4]	No. 1 servo angle value high byte	Angle1_high
Data[5]	No. 1 servo angle value low byte	Angle1_low
Data[6]	No. 2 servo angle value high byte	Angle2_high
Data[7]	No. 2 servo angle value low byte	Angle2_low
Data[8]	No. 3 servo angle value high byte	Angle3_high
Data[9]	No. 3 servo angle value low byte	Angle3_low
Data[10]	High byte of the angle value of Servo No. 4	Angle4_ high
Data[11]	Low byte of the angle value of Servo No. 4	Angle4_ low
Data[12]	High byte of the angle value of Servo No. 5	Angle5_ high
Data[13]	Low byte of the angle value of Servo No. 5	Angle5_ low
Data[14]	High byte of the angle value of Servo No. 6	Angle6_ high
Data[15]	Low byte of the angle value of Servo No. 6	Angle6_ low
Data[16]	Specified speed	Sp
Data[17]	End frame	0XFA

Send all angles to zero/restore the machine to zero position and move at 30% speed

Serial port sending example: FE FE 0F 22 00 00 00 00 00 00 00 00 00 00 00 00 1E FA

angle1_high: data type byte

Calculation method: multiply the angle value of servo No. 1 by 100, convert it to int format first, and then take the high byte of hexadecimal

angle1_low: data type byte

Calculation method: multiply the angle value of servo No. 1 by 100, convert it to int format first, and then take the low byte of hexadecimal

(The same applies to the rest)

No return value

Read all coordinates

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X23
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 23 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X0E
Data[3]	Return instruction frame	0X23
Data[4]	Specify x coordinate high	x_high
Data[5]	Specify x coordinate low	x_low
Data[6]	Specify y coordinate high	y_high
Data[7]	Specify y coordinate low	y_low
Data[8]	Specify z coordinate high	z_high
Data[9]	Specify z coordinate low	z_low
Data[10]	Specify rx coordinate high	rx_high
Data[11]	Specify the low bit of the rx coordinate	rx_low
Data[12]	Specify the high bit of the ry coordinate	ry_high
Data[13]	Specify the low bit of the ry coordinate	ry_low
Data[14]	Specify the high bit of the rz coordinate	rz_high
Data[15]	Specify the low bit of the rz coordinate	rz_low
Data[16]	End frame	0XFA

Serial port return example: FE FE 0E 23 01 BC FD A0 10 15 DC 66 FF 54 DE 21 FA

How to get the x coordinate

temp = x_low + x_high*256

x coordinate = (temp \ 33000 ?(temp – 65536) : temp)/10

Calculation method: x coordinate value low bit + x coordinate value high bit multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 10. If it is less than 33000, just divide by 10 directly

(The same applies to y coordinates and z coordinates)

How to get the rx coordinate

temp = rx_low + rx_high*256

rx coordinate = (temp \ 33000 ?(temp – 65536) : temp)/100

Calculation method: x coordinate value low bit + x coordinate value high bit multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 100. If it is less than 33000, just divide by 100 directly

(The same applies to ry coordinates and rz coordinates)

Send individual coordinate parameters

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X06
Data[3]	Command frame	0X24
Data[4]	axis	x/y/z/rx/ry/rz
Data[5]	Specify xyz/rxryrz parameter high	xyz/rxryrz_high
Data[6]	Specify xyz/rxryrz parameter low	xyz/rxryrz_low
Data[7]	Specify speed	Sp
Data[8]	End frame	0XFA

Set X coordinate to 200 and target speed to 20

Serial port sending example: FE FE 06 24 01 07 D0 14 FA

Specify axis: data type byte

Value range: 1~6

xyz_high: data type byte

Calculation method: x/y/z coordinate value multiplied by 10 and then take the high byte of hexadecimal

xyz_low: data type byte

Calculation method: x/y/z coordinate value multiplied by 10 and then take the low byte of hexadecimal

rxryrz_high: data type byte

Calculation method: rx/ry/rz multiplied by 100 and then take the high byte of hexadecimal

rxryrz_low: data type byte

Calculation method: rx/ry/rz multiplied by 100 and then take the low byte of hexadecimal

No return value

Send all coordinate parameters

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X10
Data[3]	Command frame	0X25
Data[4]	Specify x coordinate high	x_high
Data[5]	Specify x coordinate low	x_low
Data[6]	Specify y coordinate high	y_high
Data[7]	Specify y coordinate low	y_low
Data[8]	Specify z coordinate high	z_high
Data[9]	Specify z coordinate low	z_low
Data[10]	Specify rx coordinate high	rx_high
Data[11]	Specify the low bit of rx coordinate	rx_low
Data[12]	Specify the high bit of ry coordinate	ry_high
Data[13]	Specify the low bit of ry coordinate	ry_low
Data[14]	Specify the high bit of rz coordinate	rz_high
Data[15]	Specify the low bit of rz coordinate	rz_low
Data[16]	Specify the speed	Sp
Data[17]	Mode	0X01
Data[18]	End frame	0XFA

Set the target position of the end of the robot arm (150.3, -68.7, 101.8, 10.18, 0, -90), target speed 10

Serial port sending example: FE FE 10 25 05 DF FD 51 03 FA BC 30 00 00 DC D8 0A 01 FA

x_high: Data type byte

Calculation method: x coordinate multiplied by 10 and then take the high byte of hexadecimal

x_low: Data type byte

Calculation method: x coordinate multiplied by 10 and then take the low byte of hexadecimal

(The same applies to y-axis coordinates and z-axis coordinates)

rx_high: Data type byte

Calculation method: rx coordinate value multiplied by 100 and then take the high byte of hexadecimal

rx_low: Data type byte

Calculation method: rx coordinate value multiplied by 100 and then take the low byte of hexadecimal

(The same applies to ry-axis coordinates and rz-axis coordinates)

No return value

Program pause

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X26
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 26 FA

No return value

Is the program paused?

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X27
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 27 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return command frame	0X27
Data[4]	Pause/unpause	0X01/0X00
Data[5]	End frame	0XFA

Assume the program is in pause state

Serial port return example: FE FE 03 27 01 FA

Program resume

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X28
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 28 FA

No return value

Program stop

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X29
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 29 FA

No return value

Whether the point is reached

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X0E/0X0F
Data[3]	Command frame	0X2A
Data[4]	Coordinate x high byte/No. 1 servo angle value high byte	x_high/Angle1_high
Data[5]	Coordinate x low byte/No. 1 servo angle value low byte	x_low/Angle1_low
Data[6]	Coordinate y high byte/No. 2 servo angle value high byte	y_high/Angle2_high
Data[7]	Coordinate y low byte/No. 2 servo angle value low byte	y_low/Angle2_low
Data[8]	Coordinate z high byte/No. 3 servo angle value high byte	z_high/Angle3_high
Data[9]	Coordinate z low byte/No. 3 servo angle value low byte	z_low/Angle3_low
Data[10]	Coordinate rx high bit/No. 4 servo angle value high byte	rx_high/Angle4_high
Data[11]	Coordinate rx low bit/No. 4 servo angle value low byte	rx_low/Angle4_low
Data[12]	Coordinate ry high bit/No. 5 servo angle value high byte	ry_high/Angle5_high
Data[13]	Coordinate ry low bit/No. 5 servo angle value low byte	ry_low/Angle5_low
Data[14]	Coordinate rz high bit/No. 6 servo angle value high byte	rz_high/Angle6_high
Data[15]	Coordinate rz low bit/No. 6 servo angle value low byte	rz_low/Angle6_low
Data[16]	Coordinate/angle	0X01/0X00
Data[17]	End frame	0XFA

Judge whether the robot has reached the origin

Serial port sending example: FE FE 0F 2A 00 00 00 00 00 00 00 00 00 00 00 00 00 FA

x_high: data type byte

Calculation method: x coordinate multiplied by 10, first converted to int type, then take the hexadecimal high byte

x_low: data type byte

Calculation method: x coordinate multiplied by 10, first converted to int type, then take the hexadecimal low byte

(The same applies to y-axis coordinates and z-axis coordinates)

rx_high: data type byte

Calculation method: rx coordinate multiplied by 100, first converted to int type, then take the hexadecimal high byte

rx_low: data type byte

Calculation method: rx coordinate multiplied by 100, first converted to int type Then take the low byte of hexadecimal

(The same applies to the ry axis coordinates and the rz axis coordinates)

angle_high: data type byte

Calculation method: multiply the angle value by 100, convert it to int format first, and then take the high byte of hexadecimal

angle_low: data type byte

Calculation method: multiply the angle value by 100, convert it to int format first, and then take the low byte of hexadecimal

Type: data type byte (not used yet)

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return instruction frame	0X2a
Data[4]	Arrived point/unreached point	0X01/0X00
Data[5]	End frame	0XFA

Assume the robot arm has not reached the specified point

Serial port return example: FE FE 03 2A 00 FA

Robotic arm motion detection

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X2B
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 2B FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return command frame	0X2B
Data[4]	Moving/Not Moving	0X01/0X00
Data[5]	End Frame	0XFA

Assuming the program is in motion

Serial port return example: FE FE 03 2B 01 FA

jog-Joint direction movement

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X05
Data[3]	Command frame	0X30
Data[4]	Joint servo number	Joint
Data[5]	Joint servo direction	direction
Data[6]	Specified speed	sp
Data[7]	End Frame	0XFA

Set servo No. 1 to rotate clockwise at 20% speed

Serial port sending example: FE FE 05 30 01 01 14 FA

Joint number range: 1~6

di: Data type byte Value range 0 and 1

sp: Data type byte Value range 0-100

No return value

jod-absolute control

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X06
Data[3]	Command frame	0X31
Data[4]	Joint servo number	Joint
Data[5]	Joint servo angle value high byte	Angle_high
Data[6]	Low byte of joint servo angle value	Angle_low
Data[7]	Specified speed	sp
Data[8]	End frame	0XFA

Set servo No. 1 to 45°, speed 20

Serial port sending example: FE FE 06 31 01 11 94 14 FA

Joint number value range: 1~6

Angle_high: Data type byte

Calculation method: Multiply the angle value by 100, convert it to int format first, and then take the high byte of hexadecimal

Angle_low: Data type byte

Calculation method: Multiply the angle value by 100, convert it to int format first, and then take the low byte of hexadecimal

sp: Data type byte, value range 0-100

No return value

jog-coordinate direction movement

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X05
Data[3]	Command frame	0X32
Data[4]	Specified coordinates	axis
Data[5]	Joint servo direction	di
Data[6]	Specified speed	sp
Data[7]	End frame	0XFA

Set the robot arm to move in the x direction, speed 20

Serial port sending example: FE FE 05 32 01 01 14 FA

axis value range: 1~6, representing x, y, z, rx, ry, rz respectively

di: data type byte value range 0 and 1

sp: data type byte value range 0-100

No return value

jog-stepping mode

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X06
Data[3]	Command frame	0X33
Data[4]	Joint servo serial number	Joint
Data[5]	Joint servo angle value high byte	Angle_high
Data[6]	Joint servo angle value low byte	Angle_low
Data[7]	Specified speed	sp
Data[8]	End frame	0XFA

Set the angle of servo No. 1 to increase by 45 and rotate at 20% speed

Serial port sending example: FE FE 06 33 01 11 94 14 FA

Joint serial number value range: 1~6

Angle_high: Data type byte

Calculation method: Multiply the angle value by 100, convert to int format first, and then take the high byte of hexadecimal

Angle_low: Data type byte

Calculation method: Multiply the angle value by 100, convert to int format first, and then take the low byte of hexadecimal

sp: Data type byte Value range 0-100

No return value

Send potential value

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X06
Data[3]	Command frame	0X3A
Data[4]	Joint servo serial number	Joint
Data[5]	Potential value high	Encoder_high
Data[6]	Potential value low	Encoder_low
Data[7]	Specified speed	sp
Data[8]	End frame	0XFA

Example, set joint 5 to 2048 potential and rotate at 20% speed

Serial port sending example: FE FE 06 3A 05 08 00 14 FA

Joint number range: 1~6

Joint: Data type byte

Encoder_high: Data type byte

Calculation method: Take the high bit of the potential value (hexadecimal)

Encoder_low: Data type byte

Calculation method: Take the low bit of the potential value (hexadecimal)

No return value

Get potential value

Data field	Description	Data
Data[0]	Identify frame	0XFE
Data[1]	Identify frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X3B
Data[4]	Joint number	joint
Data[5]	End frame	0XFA

Get the potential value of servo No. 2

Serial port sending example: FE FE 03 3B 02 FA

Joint number range: 1-6

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X04
Data[3]	Return command frame	0X3B
Data[4]	Servo potential value high	Encoder_high
Data[5]	Servo potential value low	Encoders_low
Data[6]	End frame	0XFA

Serial port return example: FE FE 04 3B 08 07 FA

How to calculate the potential value

Potential value = potential value low bit + potential value high bit * 256

Send the potential values of six servos

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X0F
Data[3]	Command frame	0X3C
Data[4]	High byte of potential value of servo No. 1	encoder_1_high
Data[5]	Low byte of potential value of servo No. 1	encoder_1_low
Data[6]	High byte of potential value of servo No. 2	encoder_2_high
Data[7]	Low byte of potential value of servo No. 2	encoder_2_low
Data[8]	High byte of potential value of servo No. 3	encoder_3_high
Data[9]	Low byte of potential value of servo No. 3	encoder_3_low
Data[10]	No. 4 servo potential value high byte	encoder_4_high
Data[11]	No. 4 servo potential value low byte	encoder_4_low
Data[12]	No. 5 servo potential value high byte	encoder_5_high
Data[13]	No. 5 servo potential value low byte	encoder_5_low
Data[14]	No. 6 servo potential value high byte	encoder_6_high
Data[15]	No. 6 servo potential value low byte	encoder_6_low
Data[16]	Specified speed	Sp
Data[17]	End frame	0XFA

The potential value of all motors sent is 2048, and the speed is 20

Serial port sending example: FE FE 0F 3C 08 00 08 00 08 00 08 00 08 00 08 00 14 FA

(Refer to the above for sending a single potential value)

encoder_1_high: Data type byte

Calculation method: The potential value of servo No. 1 is first converted to int type and then the hexadecimal high byte is taken

encoder_1_low: Data type byte

Calculation method: The potential value of servo No. 1 is first converted to int type and then the hexadecimal low byte is taken

(The same applies to the rest)

Sp: Data type byte Value range: 0~100

No return value

Read the potential values of six servos

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X3D
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 3D FA

Return data structure

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X0E
Data[3]	Command frame	0X3D
Data[4]	High byte of the potential value of Servo No. 1	encoder_1_high
Data[5]	Low byte of the potential value of Servo No. 1	encoder_1_low
Data[6]	High byte of the potential value of Servo No. 2	encoder_2_high
Data[7]	Low byte of the potential value of Servo No. 2	encoder_2_low
Data[8]	Servo 3 potential value high byte	encoder_3_high
Data[9]	Servo 3 potential value low byte	encoder_3_low
Data[10]	Servo 4 potential value high byte	encoder_4_high
Data[11]	Servo 4 potential value low byte	encoder_4_low
Data[12]	Servo 5 potential value high byte	encoder_5_high
Data[13]	Servo 5 potential value low byte	encoder_5_low
Data[14]	Servo 6 potential value high byte	encoder_6_high
Data[15]	Servo 6 potential value low byte	encoder_6_low
Data[16]	End frame	0XFA

Assume that all joints of the current robot arm are at 0 position

Serial port return example: FE FE 0E 3D 08 00 08 00 08 00 08 00 08 00 08 00 FA

How to calculate the potential value

Potential value = potential value low bit + potential value high bit * 256

Set speed

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Instruction frame	0X41
Data[4]	Specified speed	sp
Data[5]	End frame	0XFA

Sp: Data type byte Value range: 0~100

Set the current speed to 50%

Serial port sending example: FE FE 03 41 32 FA

No return value

Read the minimum angle of the joint

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X4A
Data[4]	Joint servo serial number	Joint_number
Data[5]	End frame	0XFA

Read the minimum angle of joint No. 2

Serial port sending example: FE FE 03 4A 02 FA

joint_no value range: 1-6

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X05
Data[3]	Return command frame	0X4A
Data[4]	Joint servo number	Joint_number
Data[5]	Servo angle value high	Angle_high
Data[6]	Servo angle value low	Angle_low
Data[7]	End frame	0XFA

Serial port return example: FE FE 05 4A 02 F9 F2 FA

How to get the minimum angle of the joint

temp = angle1_low+angle1_high*256

Angle1=（temp \ 33000 ?(temp – 65536) : temp）/10

Calculation method: angle value low + angle value high multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 10. If it is less than 33000, divide by 10 directly

Read the maximum angle of the joint

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X4B
Data[4]	Joint servo serial number	joint_number
Data[5]	End frame	0XFA

joint_no value range: 1-6

Read the maximum angle of joint 2

Serial port sending example: FE FE 03 4B 02 FA

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X05
Data[3]	Return command frame	0X4B
Data[4]	Joint servo number	joint_number
Data[5]	Servo angle value high	Angle_high
Data[6]	Servo angle value low	Angle_low
Data[7]	End frame	0XFA

Serial port return example: FE FE 05 4B 02 06 72 FA

How to get the maximum angle of the joint

temp = angle1_low+angle1_high*256

Angle1=（temp \ 33000 ?(temp – 65536) : temp）/10

Calculation method: angle value low bit + angle value high bit multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 10. If it is less than 33000, just divide by 10

Set the minimum angle of the joint

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X05
Data[3]	Command frame	0X4C
Data[4]	Joint servo number	Joint_number
Data[5]	Joint servo angle value high byte	Angle_high
Data[6]	Joint servo angle value low byte	Angle_low
Data[7]	End frame	0XFA

Set the minimum angle of joint 2 to 0

joint_no value range: 1-6

angle1_high: data type byte

Calculation method: multiply the servo angle value by 100, convert it to int format first, and then take the high byte of hexadecimal

angle1_low: data type byte

Calculation method: multiply the servo angle value by 100, convert it to int format first, and then take the low byte of hexadecimal

Serial port sending example: FE FE 05 4C 02 00 00 FA

No return value

Set the maximum angle of the joint

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X05
Data[3]	Command frame	0X4D
Data[4]	Joint servo number	Joint_number
Data[5]	Joint servo angle value high byte	Angle_high
Data[6]	Joint servo angle value low byte	Angle_low
Data[7]	End frame	0XFA

Set the maximum angle of joint 2 to 45

Joint_no value range: 1-6

angle1_high: data type byte

Calculation method: Multiply the servo angle value by 100 and convert it to int format first Then take the high byte of hexadecimal

angle1_low: data type byte

Calculation method: Multiply the servo angle value by 100, convert it to int format first, and then take the low byte of hexadecimal

Serial port sending example: FE FE 05 4C 02 11 94 FA

No return value

View connection

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X50
Data[4]	Joint servo serial number	Joint_number
Data[5]	End frame	0XFA

joint_no value range: 1-6

Check whether servo No. 1 is connected

Serial port sending example: FE FE 03 50 01 FA

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X04
Data[3]	Command frame	0X50
Data[4]	Joint servo number	Joint_number
Data[5]	Connected/unconnected	0X01/0X00
Data[6]	End frame	0XFA

Servo No. 1 is connected normally

Serial port return example: FE FE 04 50 01 01 FA

Check if all servos are powered on

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X51
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 51 FA

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X03
Data[3]	Command frame	0X51
Data[4]	Power on/off	0X01/0X00
Data[5]	End frame	0XFA

Not all servos are powered on Serial port return example: FE FE 03 51 01 FA

Read servo parameters

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Command frame	0X53
Data[4]	Joint servo serial number	joint_no
Data[5]	Data address	data_id
Data[6]	End frame	0XFA

Read the proportional parameters of position P of servo No. 1

Serial port sending example: FE FE 04 53 01 15 FA

joint_no value range 1~6

Data_id: data type byte, value as shown in the following table

Address	Function	Value range	Initial value	Value analysis
20	LED alarm	0-254	0	1\0 = Turn on or off LED alarm
21	Position loop P	0-254	10	Proportional coefficient of controlling motor
22	Position loop I	0-254	0	Differential coefficient of controlling motor
23	Position loop D	0-254	1	Integral coefficient of controlling motor
24	Minimum starting force	0-1000	0	Set the minimum output torque 1000 = 100%

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X03
Data[3]	Return instruction frame	0X53
Data[4]	Return data	data
Data[5]	End frame	0XFA

Serial port return example: FE FE 03 53 10 FA

Set servo parameters of steering gear

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X05
Data[3]	Command frame	0X52
Data[4]	Joint servo serial number	joint_no
Data[5]	Data address	data_id
Data[6]	Data	data
Data[7]	End frame	0XFA

Set the position P ratio parameter of servo No. 1 to 1

Serial port sending example: FE FE 05 52 01 15 01 FA

joint_no value range: 1~6

No return value

```
data_id value is as follows
```

Address	Function	Value range	Initial value	Value analysis
20	LED alarm	0-254	0	1_0 = Turn LED alarm on or off
21	Position loop P	0-254	10	Proportional coefficient of the control motor
22	Position loop I	0-254	0	Differential coefficient of the control motor
23	Position loop D	0-254	1	Integral coefficient of the control motor
24	Minimum starting force	0-1000	0	Set the minimum output torque 1000 = 100%

Set the servo zero point

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X54
Data[4]	Joint servo serial number	joint_number
Data[5]	End frame	0XFA

Set the zero position of servo No. 1

Serial port sending example: FE FE 03 54 01 FA

joint_number:1~6

No return value

Brake a single motor

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X55
Data[4]	Joint servo number	joint_number
Data[5]	End frame	0XFA

Brake servo No. 1

joint_number:1~6

Serial port sending example: FE FE 03 55 01 FA

No return value

Power off a single motor

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X56
Data[4]	Servo serial number	Servo_no
Data[5]	End frame	0XFA

Power off servo No. 3

Serial port sending example: FE FE 03 56 03 FA

Servo_no: 1~6

No return value

Power on a single motor

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X57
Data[4]	Servo number	Servo_no
Data[5]	End frame	0XFA

Power on servo No. 1

Serial port sending example: FE FE 03 57 01 FA

Servo_no:1~6

No return value

Set atom pin mode

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Command frame	0X60
Data[4]	Pin number	pin_no
Data[5]	Input/output	00X00/00X01
Data[6]	End frame	0XFA

Set atom pin22 to input mode

Serial port sending example: FE FE 04 60 16 00 FA

Pin_no: Data type byte

Pin_mode: 0/1

No return value

Set Atom IO (setDigitalOutput)

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Instruction frame	0X61
Data[4]	Pin number	Pin_no
Data[5]	Level signal	0X00/0X01
Data[6]	End frame	0XFA

Set pin P23 to high level

Serial port sending example: FE FE 04 61 17 01 FA

No return value

Read Atom IO (getDigitalInput)

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Instruction frame	0X62
Data[4]	Pin number	pin_no
Data[5]	End frame	0XFA

Read the level signal of pin P22

Serial port sending example: FE FE 03 62 16 FA

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X04
Data[3]	Return instruction frame	0X62
Data[4]	Pin number	pin_no
Data[5]	Level signal	0X00/0X01
Data[6]	End frame	0XFA

Assume that pin P22 is high level

Serial port return example: FE FE 04 62 16 01 FA

Read the gripper angle

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X65
Data[6]	End frame	0XFA

Serial port sending example: FE FE 02 65 FA

Return data structure

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X65
Data[4]	Gripper opening range	value
Data[6]	End frame	0XFA

value: 0-100%

Assume the gripper is in full open state

Serial port return example: FE FE 03 65 64 FA

Gripper opening size = 6 * 16 + 4 = 100

Set the gripper mode

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Command frame	0X66
Data[4]	Gripper open/close	0X00/0X01
Data[5]	Speed	Sp
Data[6]	End frame	0XFA

Set the gripper to open at a speed of 50

Serial port sending example: FE FE 04 66 00 32 FA

No return value

Set the gripper angle

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Command frame	0X67
Data[4]	Gripper opening range	value
Data[6]	Speed	Sp
Data[7]	End frame	0XFA

Assume the gripper is open 50% and the speed is 20

Serial port sending example: FE FE 04 67 32 14 FA

value can be directly converted to hexadecimal

No return value

Set the gripper to zero point

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Instruction frame	0X68
Data[4]	End frame	0XFA

Set the gripper's current position to zero point

Serial port sending example: FE FE 02 68 FA

Detect whether the gripper is moving

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X69
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 69 FA

Return data structure

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X69
Data[4]	Stop/Move	00/01
Data[5]	End frame	0XFA

Assume the gripper is in the stopped state

Serial port return example: FE FE 03 69 00 FA

Set the color of the RGB light on the atom screen

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X05
Data[3]	Command frame	0X6A
Data[4]	R	0X00/0XFF
Data[5]	G	0X00/0XFF
Data[6]	B	0X00/0XFF
Data[7]	End frame	0XFA

Set RGB to blue

Serial port sending example: FE FE 05 6A 00 00 FF FA

No return value

Set the base IO output

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Command frame	0Xa0
Data[4]	Pin number	Pin_no
Data[5]	Level signal	0X00/0X01
Data[6]	End frame	0XFA

Set pin 2 to output high level

Serial port sending example: FE FE 04 a0 02 01 FA

Read base IO output

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0Xa1
Data[4]	Pin number	Pin_no
Data[5]	End frame	0XFA

Serial port sending example: FE FE 03 a1 02 FA

Return data structure

Data field	Description	Data
Data[0]	Return identification frame	0XFE
Data[1]	Return identification frame	0XFE
Data[2]	Return data length frame	0X04
Data[3]	Return instruction frame	0Xa1
Data[4]	Pin number	Pin_no
Data[5]	Level signal	0X00/0X01
Data[6]	End frame	0XFA

Assume that pin 2 is high level

Serial port return example: FE FE 04 a1 02 01 FA

Get WiFi account & password

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0Xb1
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 b1 FA

Serial port return example: ssid: MyCobotWiFi2.4G password: mycobot123

ssid: WiFi account

password: WiFi password

Set port number

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X04
Data[3]	Command frame	0Xb2
Data[4]	Port number high byte	port_high
Data[5]	Port number low byte	port_low
Data[6]	End frame	0XFA

Assume that the port number is set to 7000

Serial port sending example: FE FE 04 b2 1b 58 FA

port_high: port number hexadecimal high byte

port_low: port number hexadecimal low byte

No return value

Set tool coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X0E
Data[3]	Command frame	0X81
Data[4]	Specify the high bit of the x coordinate	x_high
Data[5]	Specify the low bit of the x coordinate	x_low
Data[6]	Specify the high bit of the y coordinate	y_high
Data[7]	Specify the low bit of the y coordinate	y_low
Data[8]	Specify the high bit of the z coordinate	z_high
Data[9]	Specify the low bit of the z coordinate	z_low
Data[10]	Specify the high bit of the rx coordinate	rx_high
Data[11]	Specify the low bit of the rx coordinate	rx_low
Data[12]	Specify the high bit of the ry coordinate	ry_high
Data[13]	Specify the low bit of the ry coordinate	ry_low
Data[14]	Specify the high bit of the rz coordinate	rz_high
Data[15]	Specify the low bit of the rz coordinate	rz_low
Data[16]	End frame	0XFA

Assume that (0, 0, 50, 0, 0, 0) is set as the tool coordinate system

Serial port sending example: FE FE 0E 81 00 00 00 00 13 88 00 00 00 00 00 00 FA

No return value

Get tool coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X82
Data[6]	End frame	0XFA

Serial port sending example: FE FE 02 82 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X0E
Data[3]	Return command frame	0X82
Data[4]	Specify the high bit of the x coordinate	x_high
Data[5]	Specify the low bit of the x coordinate	x_low
Data[6]	Specify the high bit of the y coordinate	y_high
Data[7]	Specify the low bit of the y coordinate	y_low
Data[8]	Specify the high bit of the z coordinate	z_high
Data[9]	Specify the low bit of the z coordinate	z_low
Data[10]	Specify the high bit of the rx coordinate	rx_high
Data[11]	Specify the low bit of the rx coordinate	rx_low
Data[12]	Specify the high bit of the ry coordinate	ry_high
Data[13]	Specify the low bit of the ry coordinate	ry_low
Data[14]	Specify the high bit of the rz coordinate	rz_high
Data[15]	Specify the low bit of the rz coordinate	rz_low
Data[16]	End frame	0XFA

Serial port return example: FE FE 0E 82 00 00 00 00 13 88 00 00 00 00 00 00 FA

How to get the x coordinate

temp = x_low + x_high*256

x coordinate = (temp \ 33000 ? (temp – 65536) : temp) / 10

Calculation method: x coordinate value low + x coordinate value high multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 10. If it is less than 33000, directly divide by 10

(The same applies to y coordinate and z coordinate)

How to get the rx coordinate

temp = rx_low + rx_high*256

x coordinate = (temp \ 33000 ? (temp – 65536) : temp）/100

Calculation method: x coordinate value low bit + x coordinate value high bit multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 100. If it is less than 33000, divide by 100 directly

(ry coordinate and rz coordinate are the same)

Set the world coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X0E
Data[3]	Instruction frame	0X83
Data[4]	Specify x coordinate high bit	x_high
Data[5]	Specify x coordinate low bit	x_low
Data[6]	Specify y coordinate high bit	y_high
Data[7]	Specify the low bit of the y coordinate	y_low
Data[8]	Specify the high bit of the z coordinate	z_high
Data[9]	Specify the low bit of the z coordinate	z_low
Data[10]	Specify the high bit of the rx coordinate	rx_high
Data[11]	Specify the low bit of the rx coordinate	rx_low
Data[12]	Specify the high bit of the ry coordinate	ry_high
Data[13]	Specify the low bit of the ry coordinate	ry_low
Data[14]	Specify the high bit of the rz coordinate	rz_high
Data[15]	Specify the low bit of the rz coordinate	rz_low
Data[16]	End frame	0XFA

Assume that (0, 0, 50, 0, 0, 0) is set as the world coordinate system

Serial port sending example: FE FE 0E 83 00 00 00 00 13 88 00 00 00 00 00 00 FA

No return value

Get the world coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Instruction frame	0X84
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 82 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X0E
Data[3]	Return command frame	0X84
Data[4]	Specify x coordinate high	x_high
Data[5]	Specify x coordinate low	x_low
Data[6]	Specify y coordinate high	y_high
Data[7]	Specify y coordinate low	y_low
Data[8]	Specify z coordinate high	z_high
Data[9]	Specify z coordinate low	z_low
Data[10]	Specify rx coordinate high	rx_high
Data[11]	Specify rx coordinate low	rx_low
Data[12]	Specify ry coordinate high	ry_high
Data[13]	Specify ry coordinate low	ry_low
Data[14]	Specify rz coordinate high	rz_high
Data[15]	Specify the low bit of the rz coordinate	rz_low
Data[16]	End frame	0XFA

Serial port return example: FE FE 0E 84 00 00 00 00 13 88 00 00 00 00 00 00 FA

How to get the x coordinate

temp = x_low + x_high*256

x coordinate = (temp \ 33000 ?(temp – 65536) : temp)/10

Calculation method: x coordinate value low bit + x coordinate value high bit multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 100. If it is less than 33000, directly divide by 10

(The same applies to the y coordinate and the z coordinate)

How to get the rx coordinate

temp = rx_low + rx_high*256

x coordinate = (temp \ 33000 ? (temp – 65536) : temp) / 100

Calculation method: x coordinate value low bit + x coordinate value high bit multiplied by 256 First determine whether it is greater than 33000 If it is greater than 33000, subtract 65536 and finally divide by 100. If it is less than 33000, directly divide by 100

(ry coordinate and rz coordinate are the same)

Set base coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Instruction frame	0X85
Data[4]	Base coordinate/world coordinate	00/01
Data[5]	End frame	0XFA

Assume that the coordinate system is set to the world coordinate system

Serial port sending example: FE FE 03 85 01 FA

No return value

Get the base coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Instruction frame	0X86
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 86 FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return command frame	0X86
Data[4]	Base coordinates/world coordinates	00/01
Data[4]	End frame	0XFA

Serial port return example: FE FE 03 86 01 FA

Set end coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X03
Data[3]	Command frame	0X89
Data[4]	Flange/tool	00/01
Data[5]	End frame	0XFA

Assume that the end coordinate system is set to tool

Serial port sending example: FE FE 03 89 01 FA

No return value

Get the end coordinate system

Data field	Description	Data
Data[0]	Identification frame	0XFE
Data[1]	Identification frame	0XFE
Data[2]	Data length frame	0X02
Data[3]	Command frame	0X8a
Data[4]	End frame	0XFA

Serial port sending example: FE FE 02 8a FA

Return data structure

Data field	Description	Data
Data[0]	Return frame header	0XFE
Data[1]	Return frame header	0XFE
Data[2]	Return length frame	0X03
Data[3]	Return command frame	0X8a
Data[4]	Flange/Tool	00/01
Data[4]	End frame	0XFA

Serial port return example: FE FE 03 8a 01 FA

Appendix:

Added corresponding coordinate transformation programs in the ATOM library and kinematics library. The specific implementation methods are as follows:

1. Change the end coordinate system
2. The end coordinate system can be set through the setEndType and getEndType functions. EndType::FLANGE sets the end to the flange, and EndType::TOOL sets the end to the tool end.
3. The coordinate information of the tool can be set through the setToolReference and getToolReference functions. When setting, the flange coordinate system is used as the relative coordinate system, and the tool end information is relative to the flange coordinate system.
4. After setting EndType to FLANGE, the GetCoords and WriteCoords methods are calculated based on the flange position.
5. After setting EndType to TOOL, the GetCoords and WriteCoords methods are calculated based on the tool end position.
6. Change the base coordinate system

7. The base coordinate system can be set through the setReferenceFrame function. RFType::BASE uses the robot base as the base coordinate, and RFType::WORLD uses the world coordinate system as the base coordinate. The getReferenceFrame function is used to read the current base coordinate system type.
8. The setWorldReference and getWorldReference functions can be used to set and read the base coordinate system information. When setting, the world coordinate system is used as the relative coordinate system, and the position information of the robot's base relative to the world coordinate system is input.
9. When the base coordinate system is the base, the GetCoords and WriteCoords methods both use the base as the reference coordinate system.
10. When the base coordinate system is the world coordinate system, the GetCoords and WriteCoords methods both use the world coordinate system as the reference coordinate system.

Communication related changes (temporary)

Now add the setting and reading of the end coordinate system, the setting and reading of the world coordinate system, the setting and reading of the current reference coordinate system, the setting and reading of the end type, the setting and reading of the movement method, and the sending and receiving of the robot information.

These communications are temporarily set to 0x80 to 0x8A

In the ParameterList.h file, add a new roboticMessages space for adding robot communication information. Now only temporarily add the prompt of "no inverse solution", which can be added later.

The simple design idea of MOVEL function is as follows:

Calculate the Euclidean distance between the initial point and the target point, and insert an interpolation point every 10mm based on the Euclidean distance. If there is no inverse solution for the interpolation point, search for an inverse solution in the adjacent space of positive and negative PI/30 in the three directions of the unchanged position, mainly to avoid singular values and some special positions where the solution cannot be found.

The point sending interval of MOVEL and JOG is changed to dynamic time. The moving time is calculated according to the maximum joint moving distance between the two points, and then the moving time minus the specific time is used as the time interval.

Chapter 7 Successful Cases

myCobot 280 series robot arms support more than ten kinds of accessories, including bases, end extensions, peripheral products, etc. Multiple accessories can be stacked to complete complex project applications and meet the needs of commercial exhibitions, such as robot application model display, educational teaching package display, and industrial 4.0 application scenario display. Supports multiple mainstream programming languages such as python and C++ to meet the diverse needs of developers.

User case display video

【Application Case】Elephant Robot myCobot Elephant Robot Arm Creative Video Collection

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280 PLC IO Interactive Control Case

1. Functional Effect Description

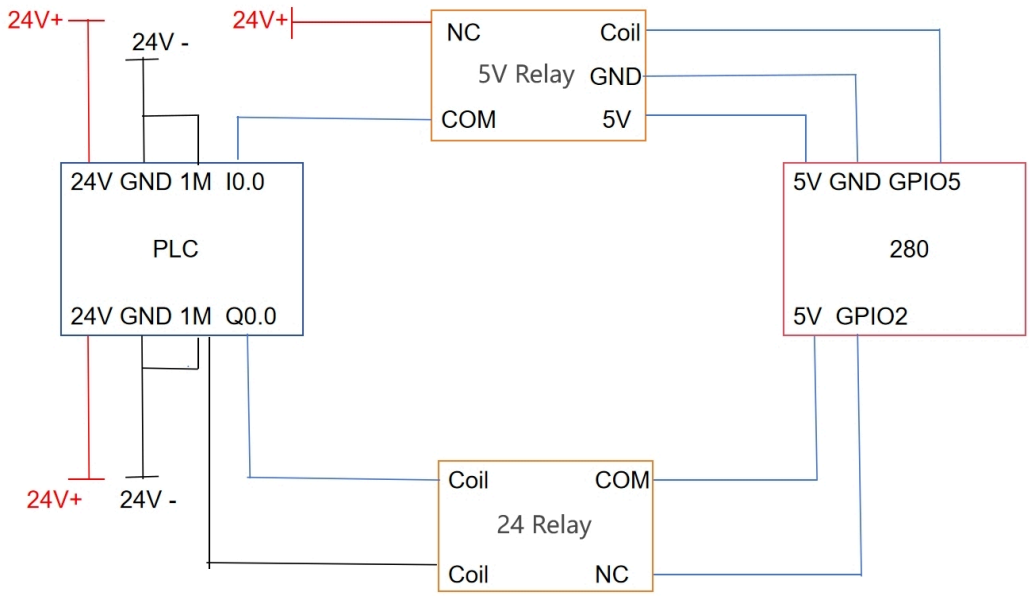
After receiving the IO signal from the PLC, the robot arm will perform an action to return each joint to zero position

2. Principle Description

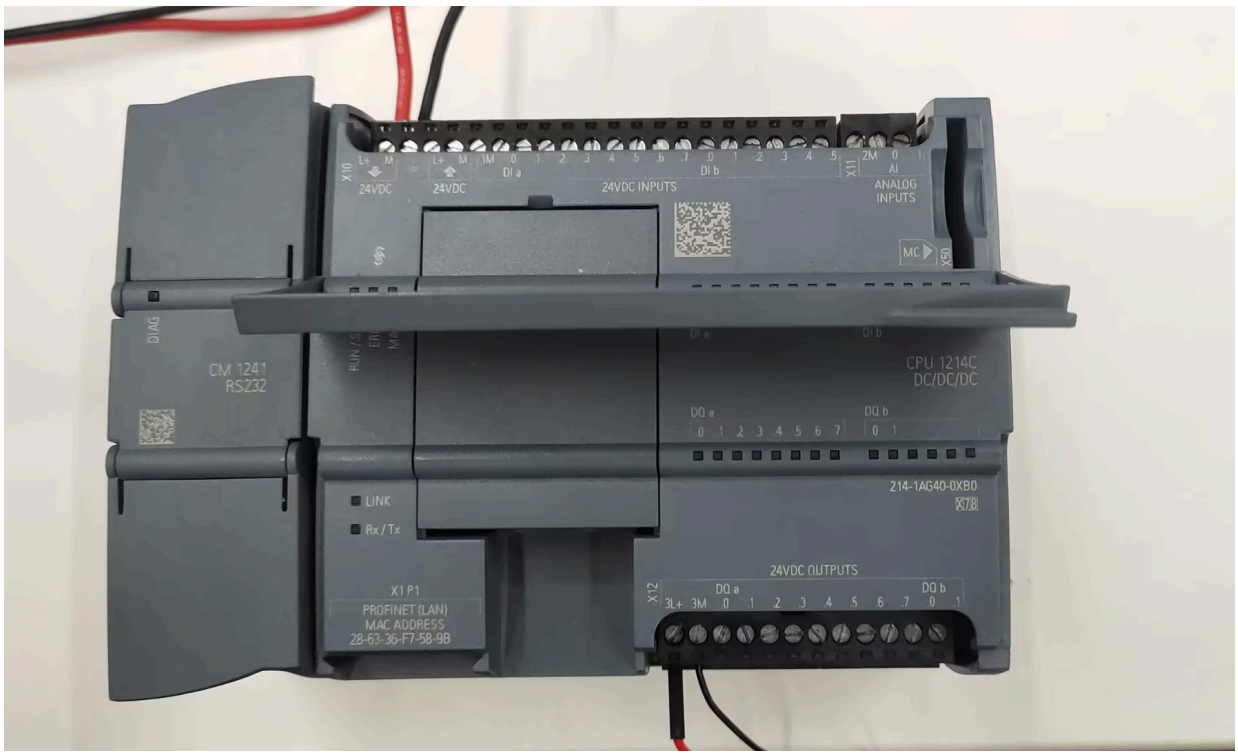
Since the input and output of the robot arm is 3.3V and the input and output of the PLC is 24V, a 5V relay and a 24V relay are required. The output end of the robot arm will first output a signal to energize the 5V relay coil, connect the normally open contacts, and pass the 24V signal to the input end of the PLC. After the PLC collects the input signal, the PLC output end will output a signal to energize the 24V relay coil, connect the normally open contacts, and pass the 3.3V signal to the input end of the robot arm. After the robot arm collects the input signal, it will perform an action of returning each joint to zero position

3. Hardware Link

Overall connection diagram



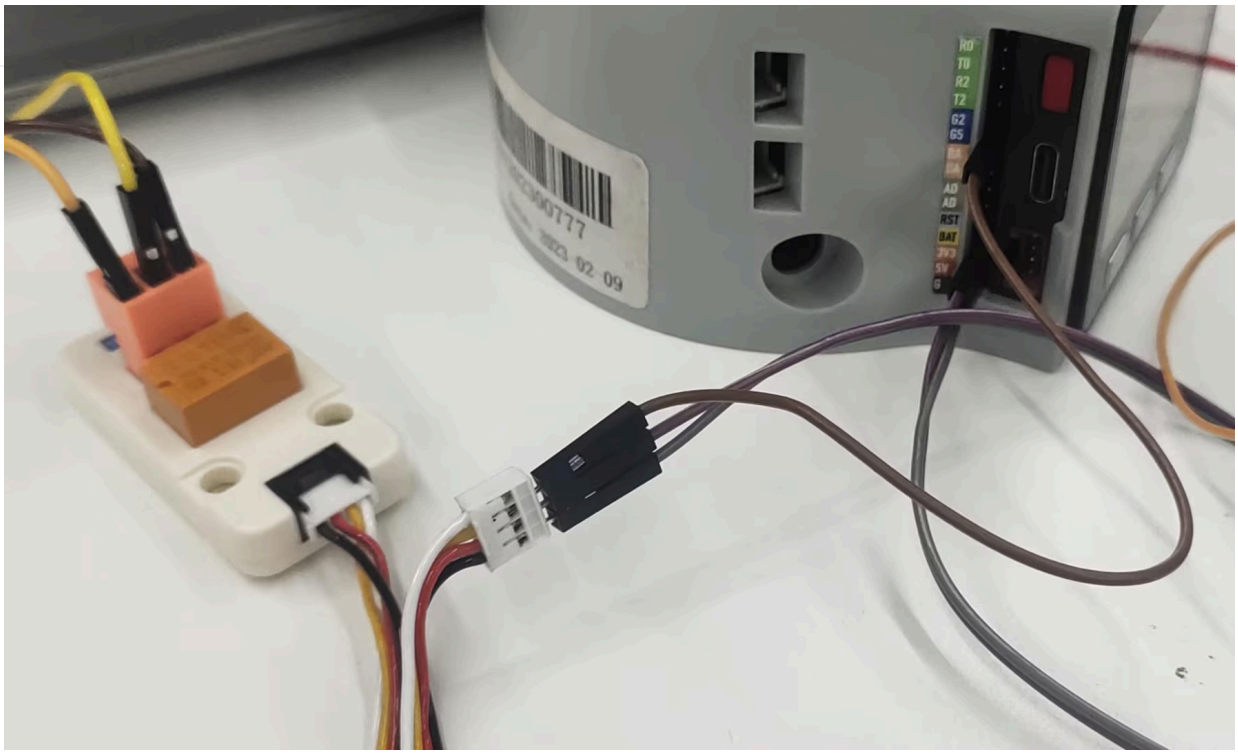
Wiring of the input of the robot arm and the output of the PLC First connect the PLC to a 24V power supply



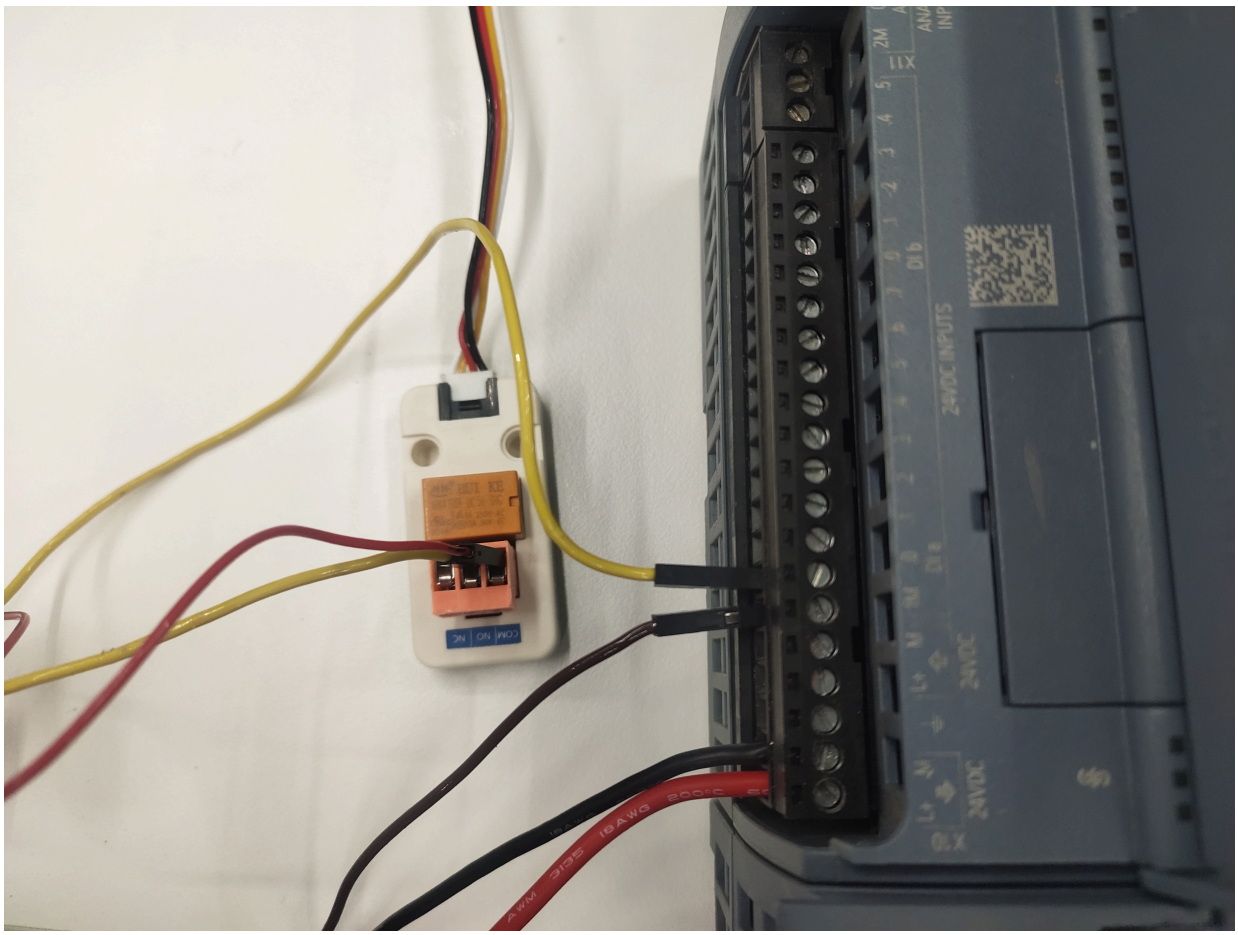
Then connect the PLC output to the 24V relay coil

Connect the robot's GPIO2 and 3.3V to the normally open contact of the 24V relay

Connect the robot's output to the PLC's input Connect the 5v, GND and GPIO5 of the robot to the coil of the 5V relay



Then connect the positive pole of 24V to the COM terminal of the 5V relay, the negative pole of 24V to the 1M terminal of the PLC, and NO to the input of the PLC

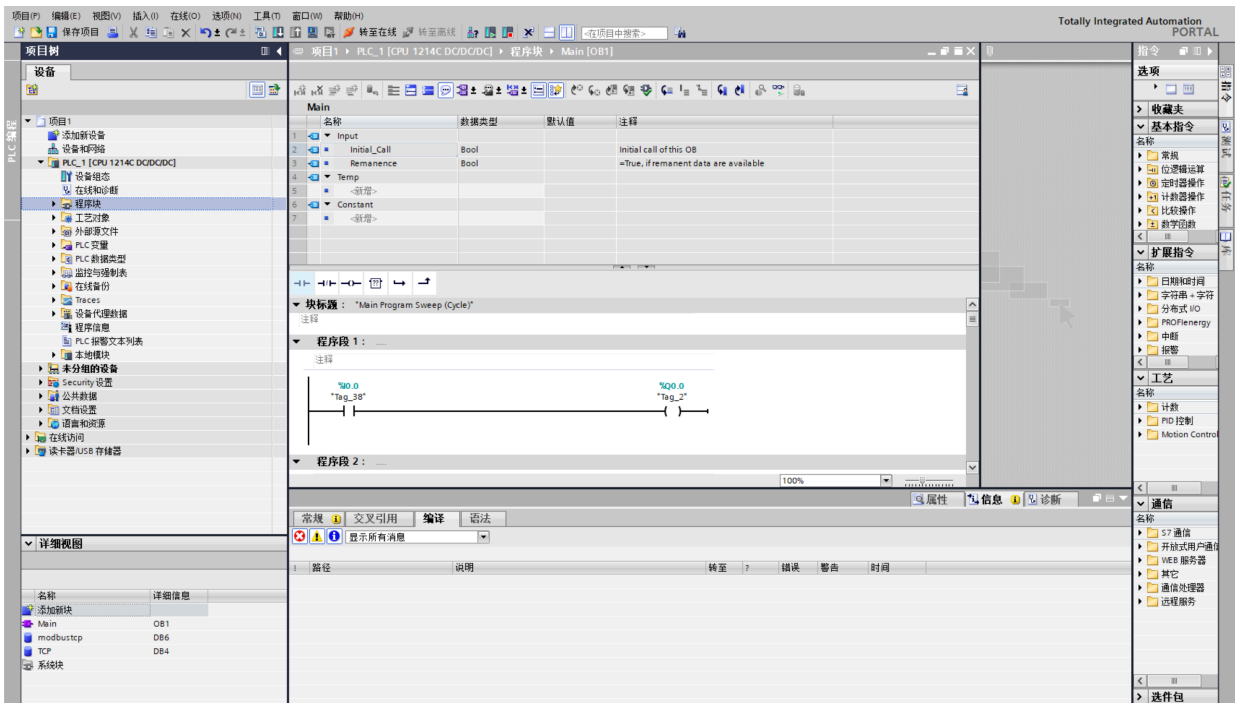


4 Software Programming

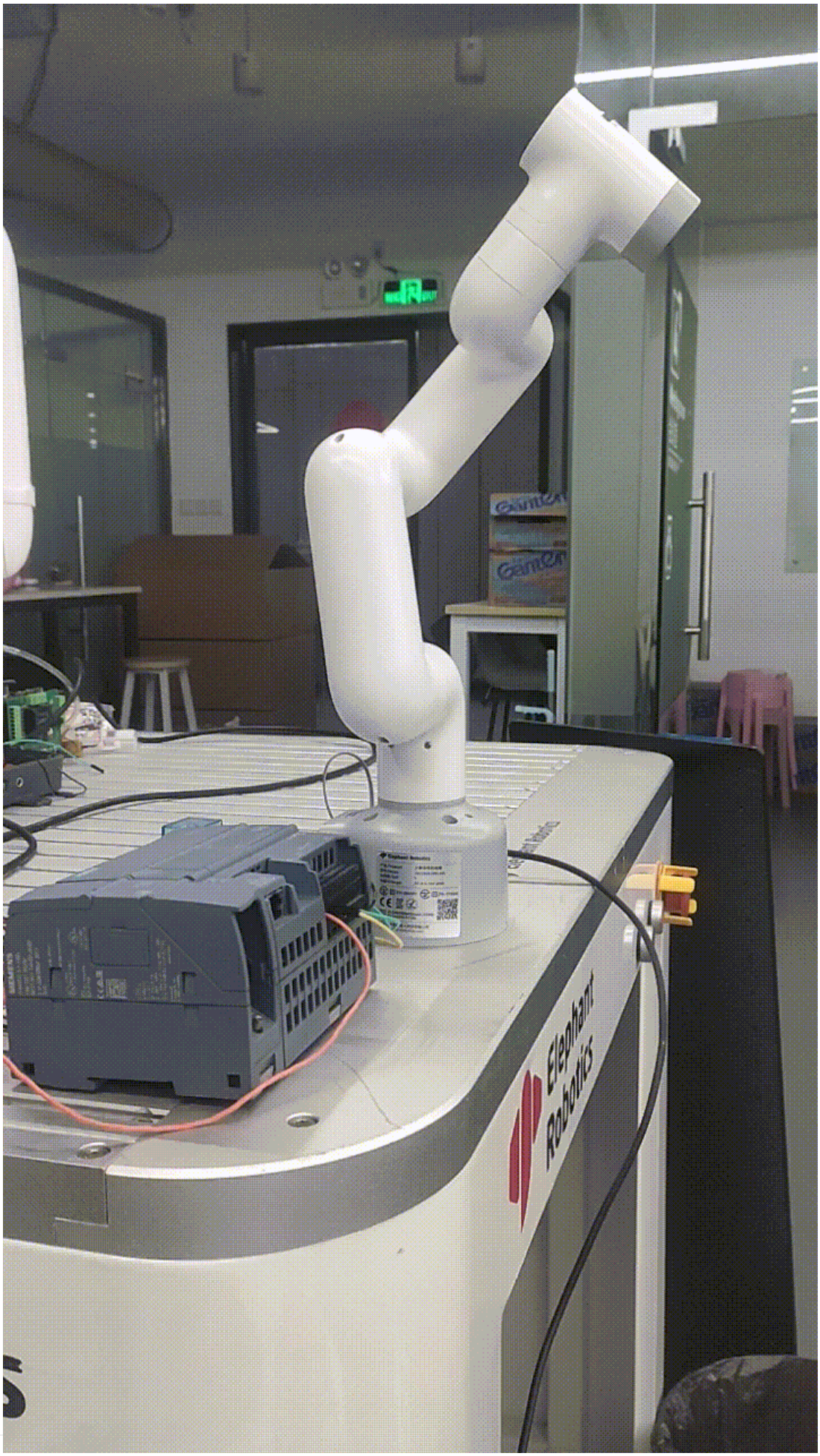
Robot Program

```
import time
mc=MyCobot("COM6")
mc.set_basic_output(5,1)
while 1:
if mc.get_basic_input(2)==1:
mc.sync_send_angles([0,0,0,0,0,0],50)
break
else:
pass
mc.set_basic_output(5,0)
```

PLC program



5. Effect display


Elephant
Robotics

← Previous chapter | Next chapter →

Robot gripper carrying wooden block example

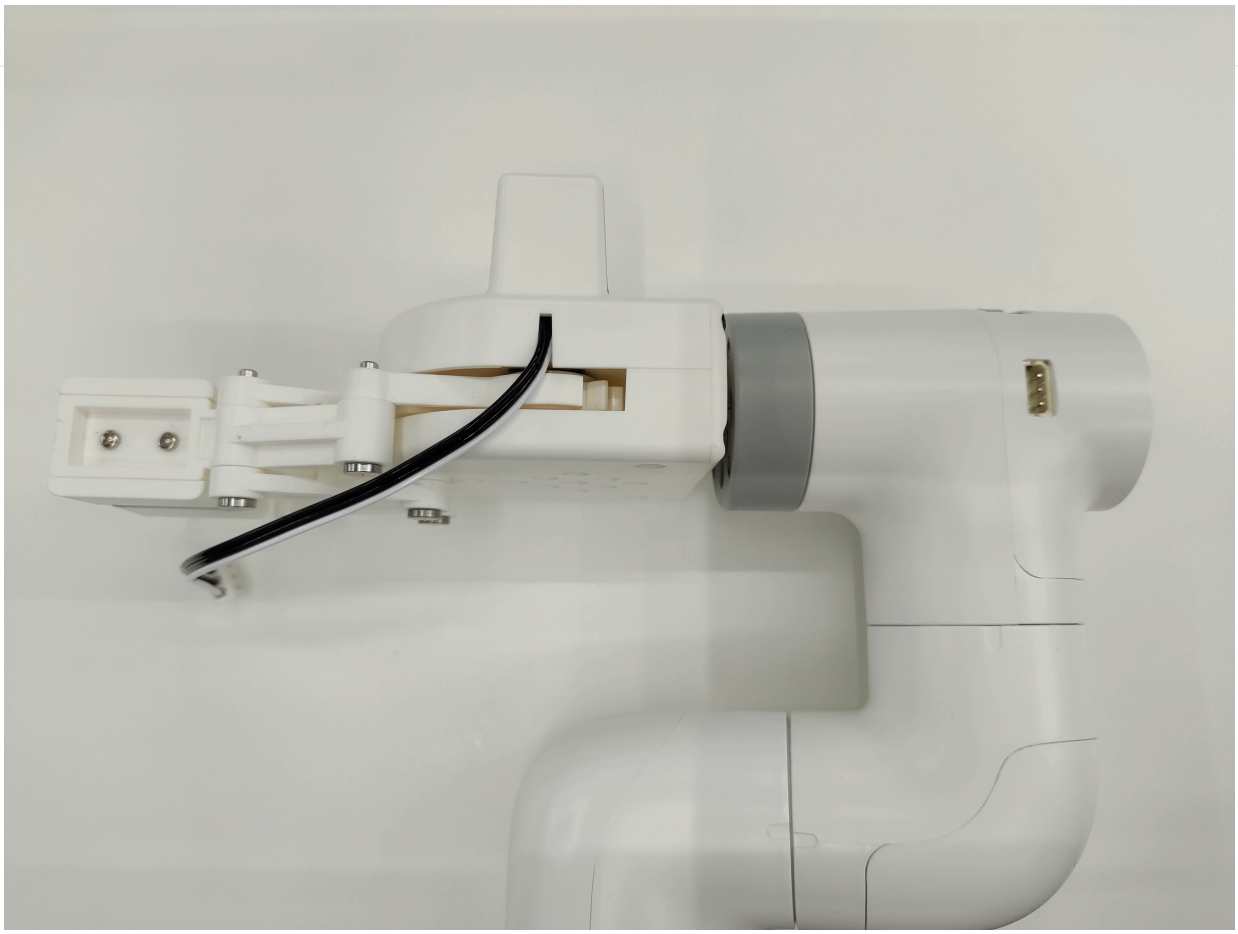
1 Functional description

The robot will use the gripper to carry the wooden block from point A to point B

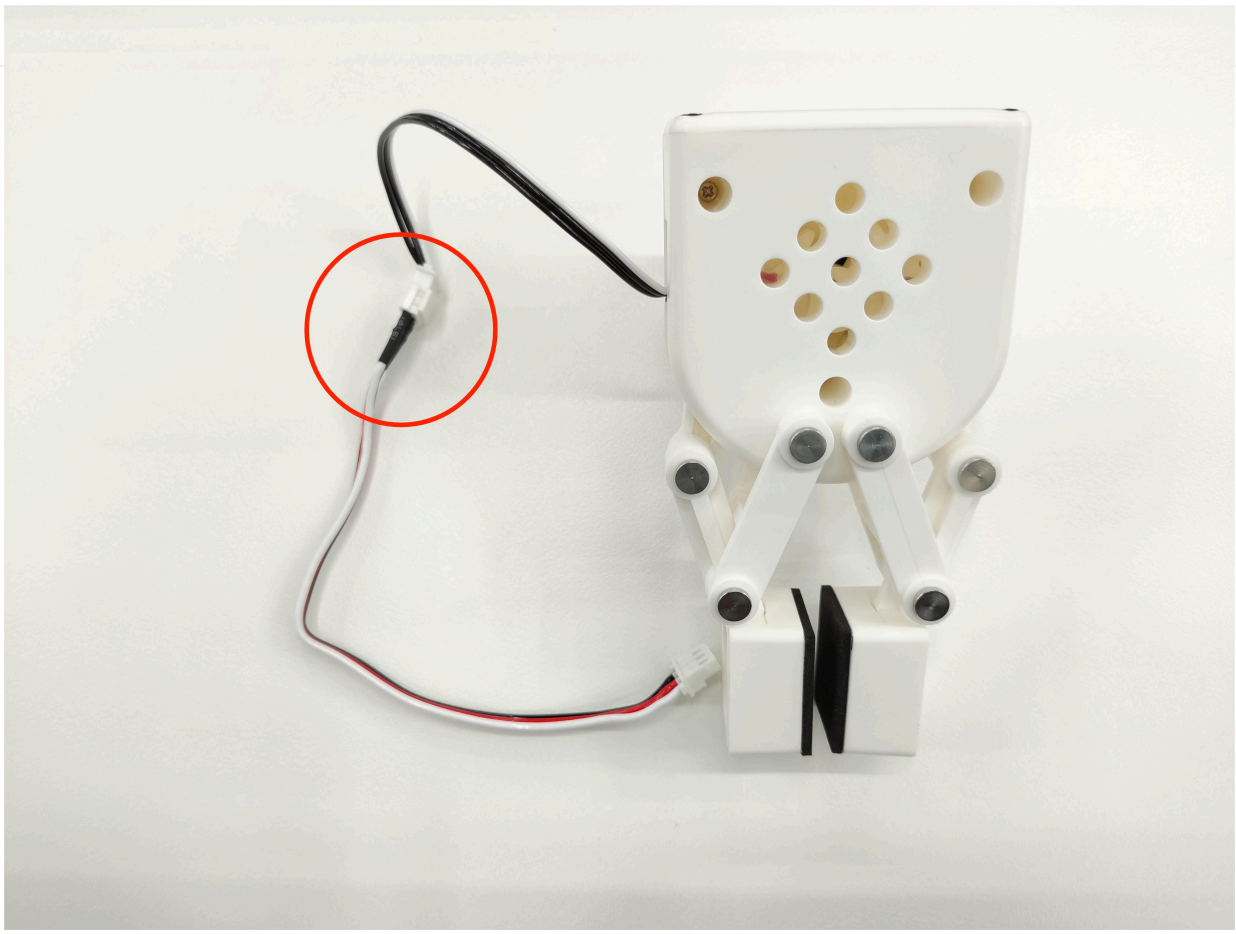
2 Hardware installation

Insert the Lego connector into the reserved socket of the gripper

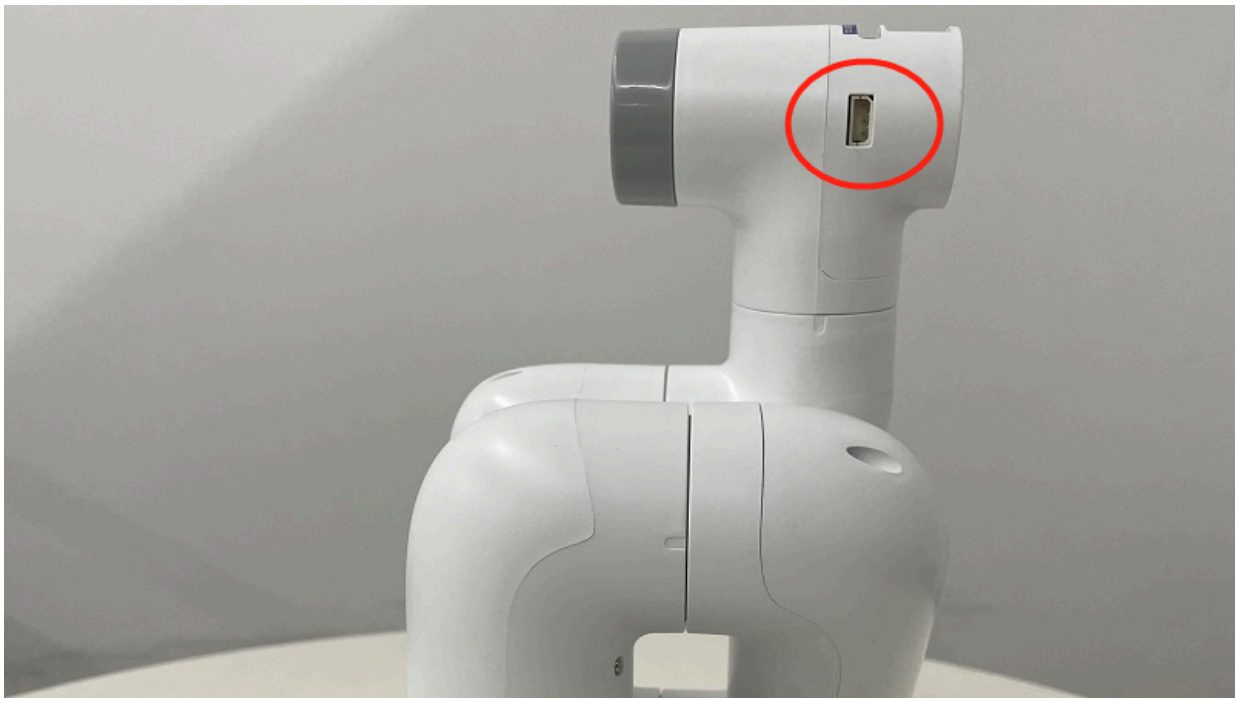
Align the gripper with the connector inserted into the socket at the end of the robot arm and insert it

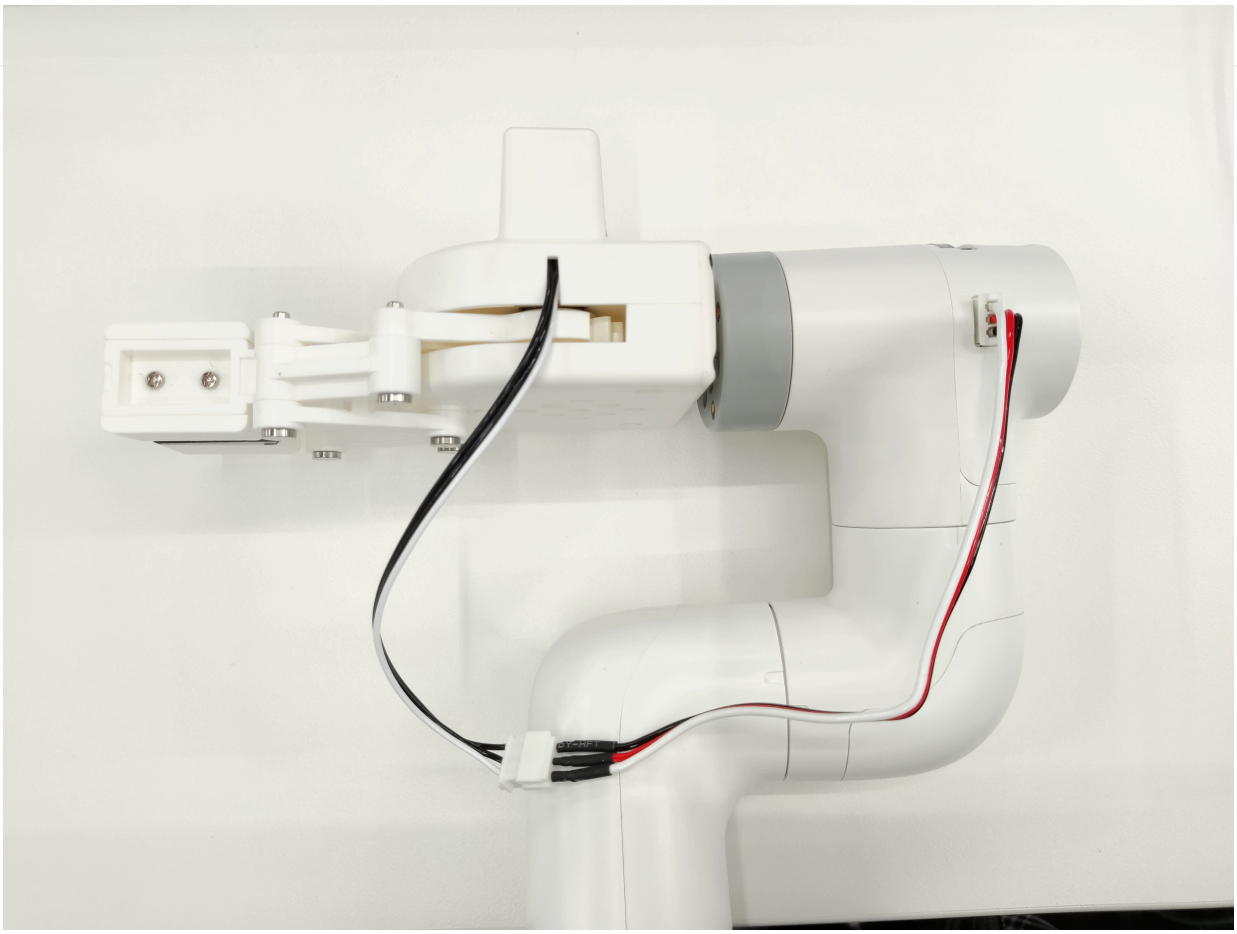


Connect the extension cable to the gripper



Insert the robot arm control interface





3 Gripper test

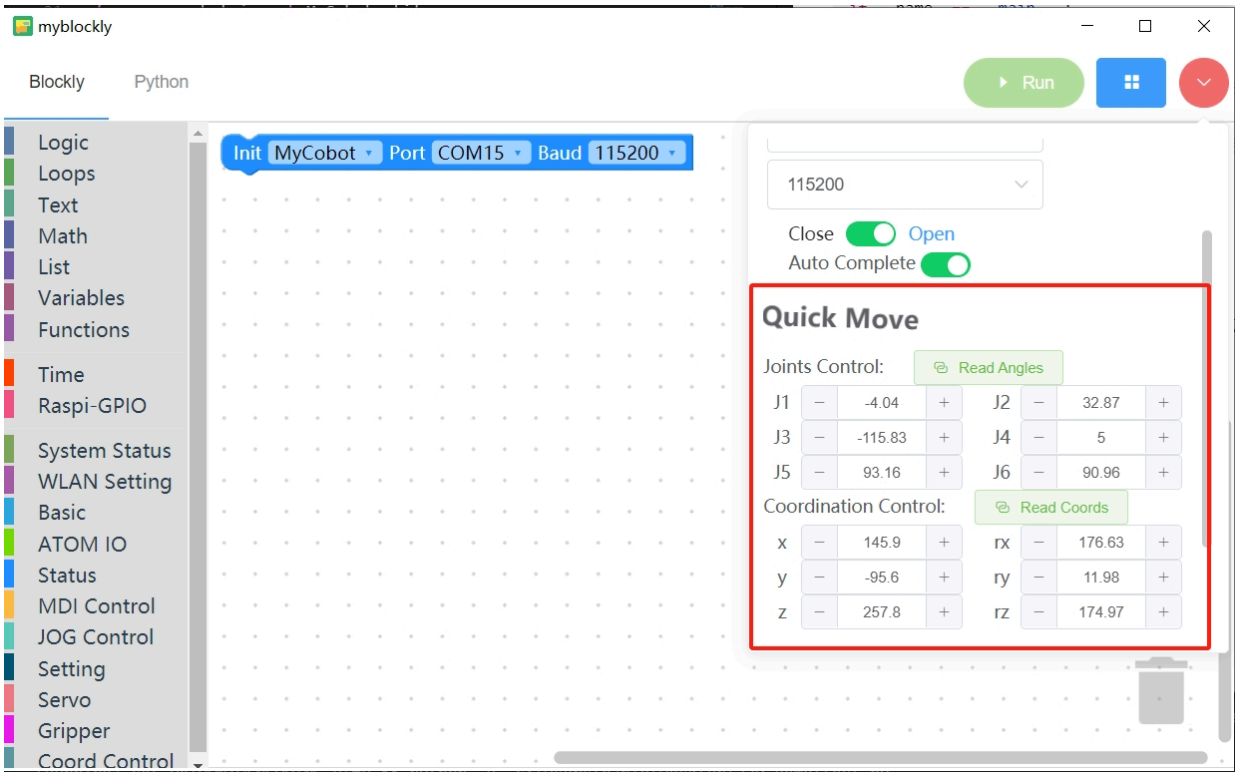
Run the following program, the gripper will repeat the closing and opening action twice

```
from pymycobot import MyCobot280,PI_PORT,PI_BAUD
import time


arm=MyCobot280(PI_PORT,PI_BAUD)
for i in range(2):
    arm.set_gripper_state(1,100)
    time.sleep(1)
    arm.set_gripper_state(1,100)
    time.sleep(1)
```

4 Software Usage

Use the fast movement function of myblockly to teach the grabbing point and placement point of the wooden block, and record the position information. After teaching, you need to disconnect the serial port connection, otherwise the serial port will be reported when running the python script. The error is that the serial port is occupied.



5 Composite application

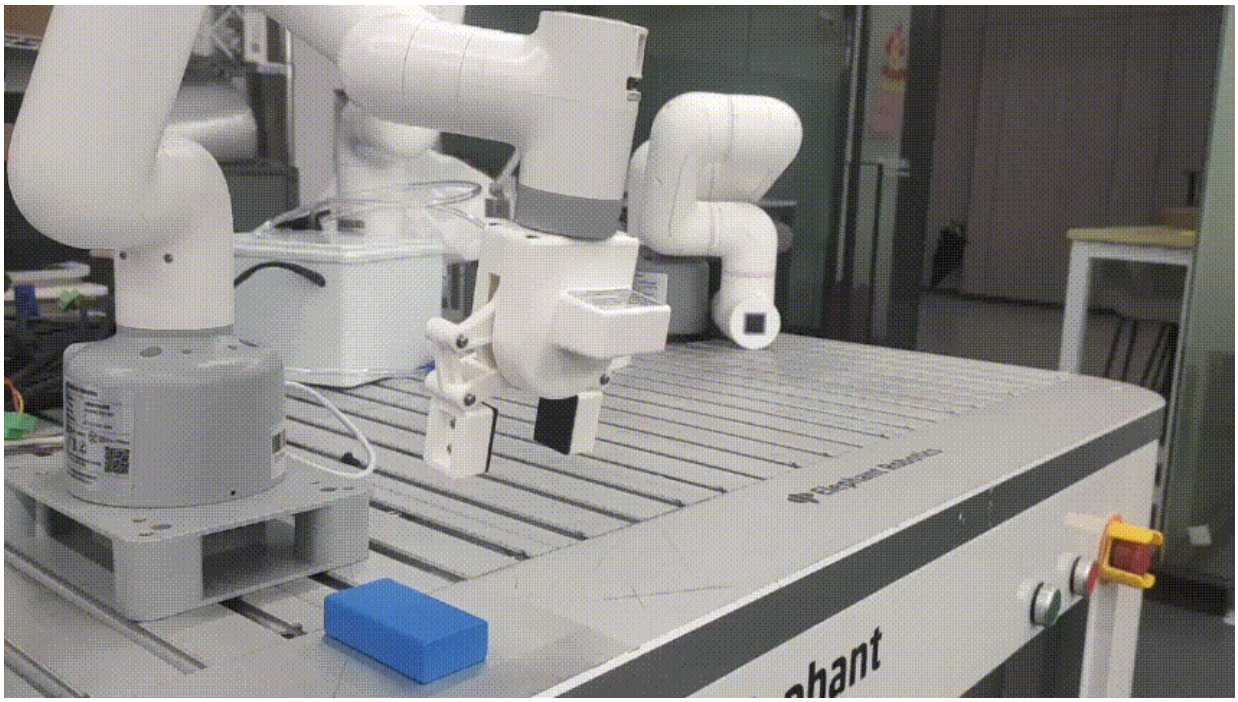
```
from pymycobot import MyCobot280,PI_PORT,PI_BAUD
import time

init_angles=[-3.25, -2.46, -95.09, 9.22, 86.39, 93.33]#6 joint angles at the initial position
grab_point=[214.5, -189.9, 185.5, -177.5, 1.91, 173.49]#Coordinates of the gripping point
place_point=[214.5, -50.9, 185.5, -177.5, 1.91, 173.49]#Coordinates of the placement point

arm=MyCobot280(PI_PORT,PI_BAUD)
if __name__=="__main__":
    arm.set_gripper_state(0,100)#Open the gripper first
    time.sleep(1)
    arm.send_angles(init_angles,100)#Initial position of movement
    time.sleep(2)
    arm.send_coords([grab_point[0],grab_point[1],grab_point[2]+70,grab_point[3],grab_point[4],grab_point[5]],100,1)#Move t
    time.sleep(2)
    arm.send_coords([grab_point[0],grab_point[1],grab_point[2],grab_point[3],grab_point[4],grab_point[5]],100,1)#Move to t
    time.sleep(2)
    arm.set_gripper_state(1,100)#Clamp the gripper
    time.sleep(1)
    arm.send_coords([grab_point[0],grab_point[1],grab_point[2]+70,grab_point[3],grab_point[4],grab_point[5]],100,1)#Move t
    time.sleep(2)

    arm.send_coords([place_point[0],place_point[1],place_point[2]+70,place_point[3],place_point[4],place_point[5]],100,1)#
    time.sleep(2)
    arm.send_coords([place_point[0],place_point[1],place_point[2],place_point[3],place_point[4],place_point[5]],100,1)#Mov
    time.sleep(2)
    arm.set_gripper_state(0,100)#Open the gripper
    time.sleep(1)
    arm.send_coords([place_point[0],place_point[1],place_point[2]+70,place_point[3],place_point[4],place_point[5]],100,1)#
    time.sleep(2)
```

6 Effect display



Robot suction pump to carry wooden blocks

1 Functional description

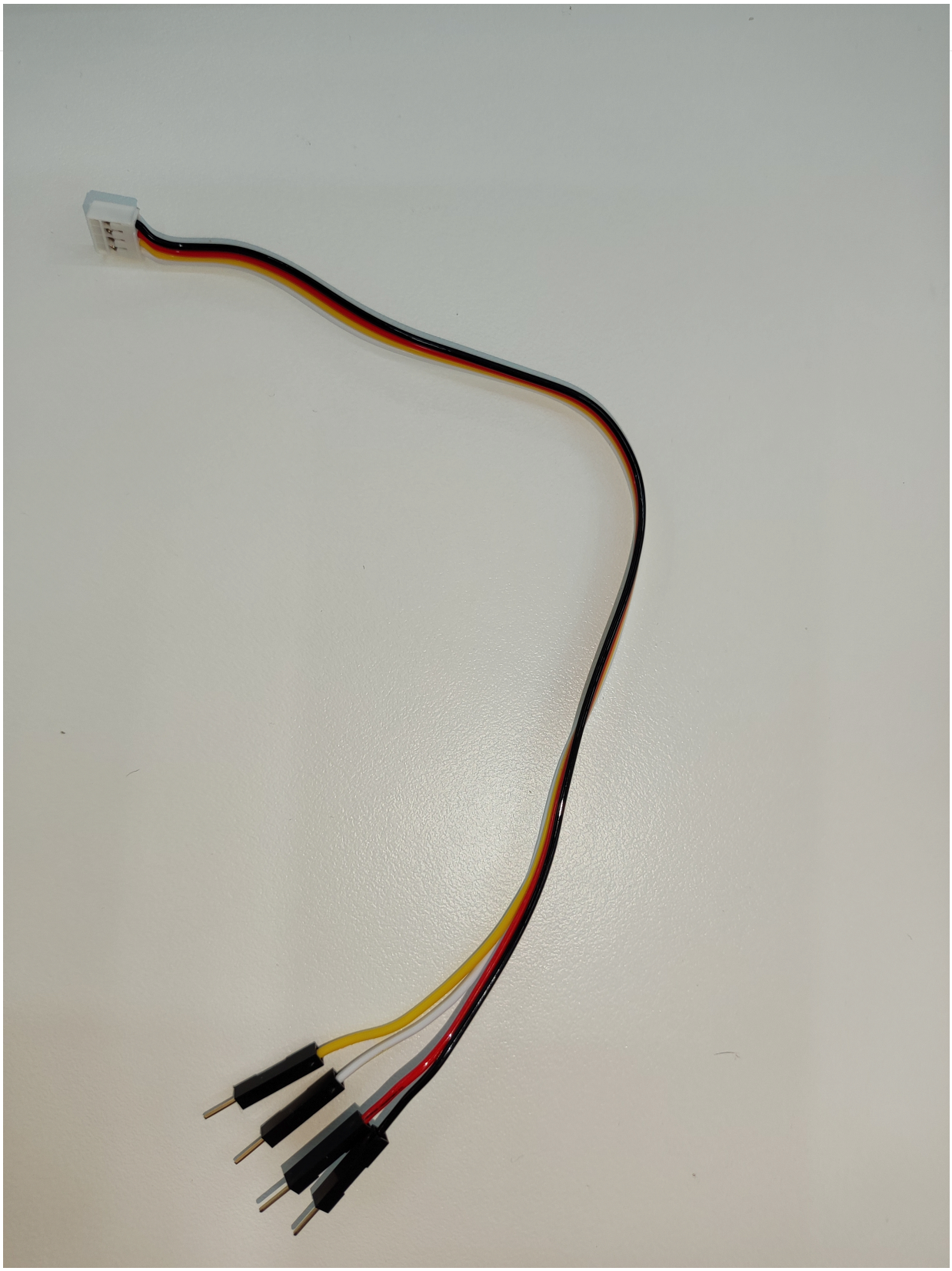
The robot will use the suction pump to carry wooden blocks from point A to point B

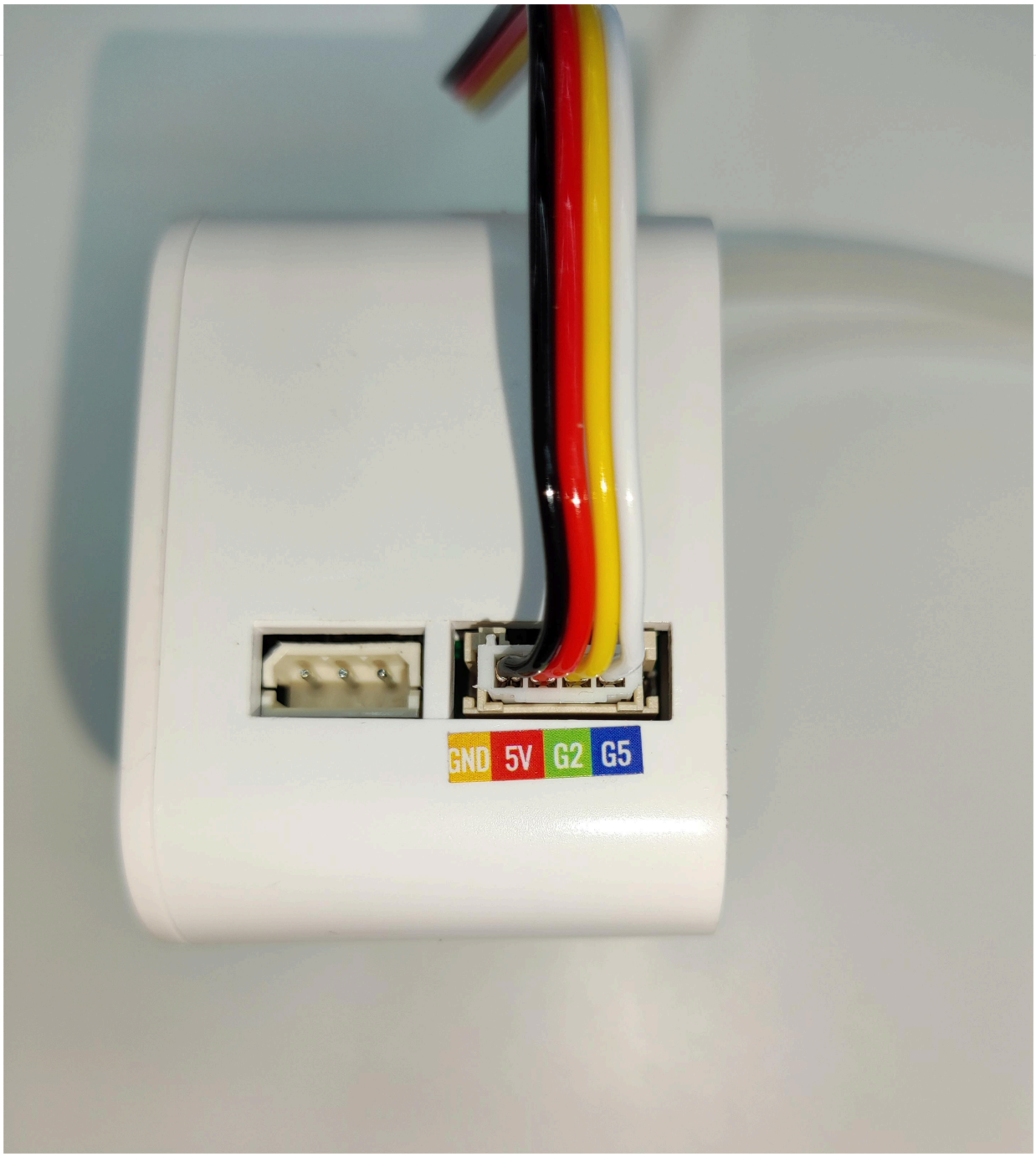
2 Hardware installation

Insert the Lego connector into the reserved socket on the suction pump

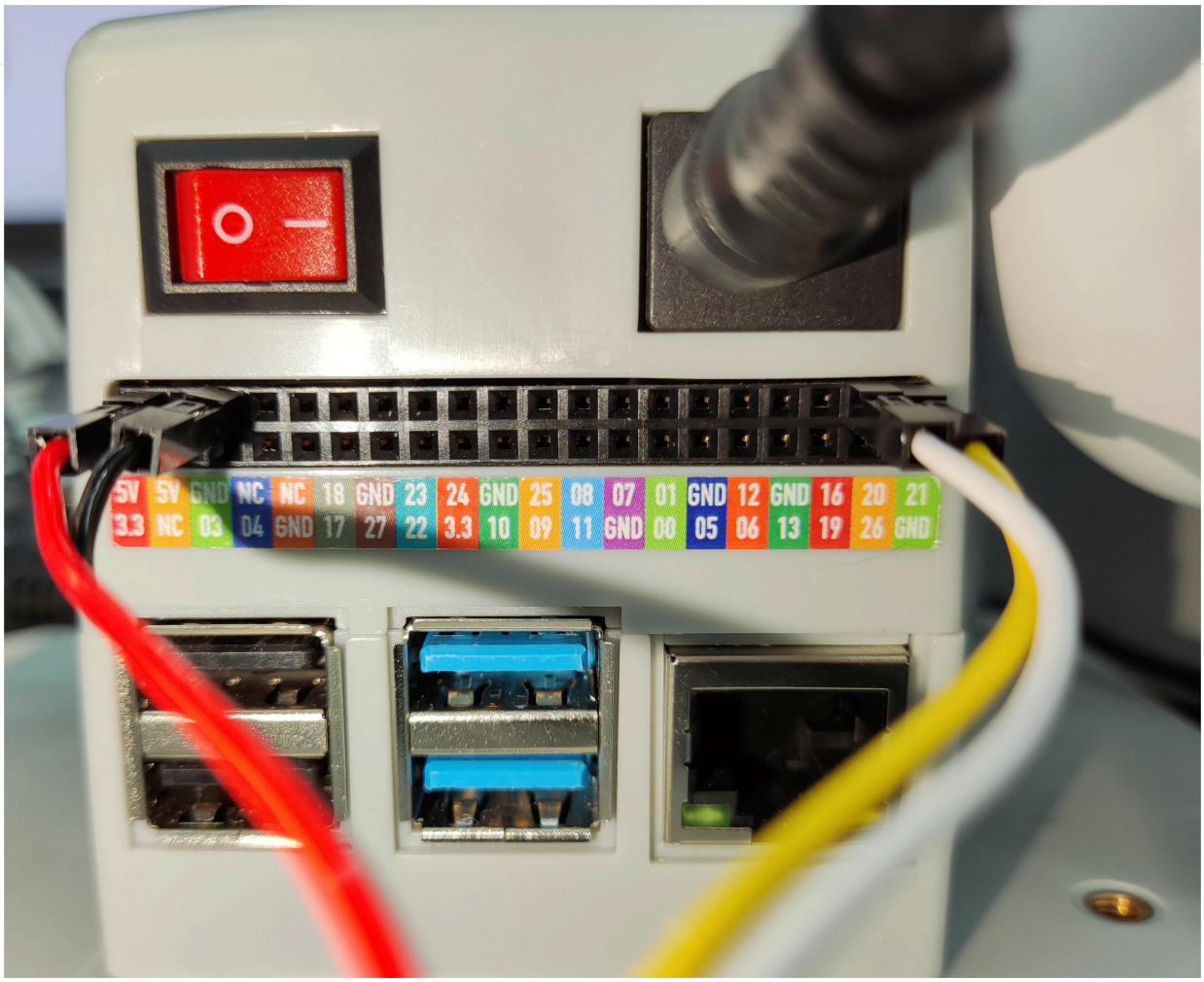
Align the suction pump with the connector inserted into the socket at the end of the robot arm

Select the male-female DuPont wire, and insert the female end into the socket marked with pins on the suction pump box





Then connect the wire to the base IO of the robot arm



> The left side is the suction pump pin, and the right side is the robot arm pin GND -> GND 5V -> 5V G2 -> 21 G5 -> 20

3 Pump test

Run the following program, the pump will repeat the opening and closing action twice

```
from pymycobot import MyCobot280,PI_PORT,PI_BAUD
import time
import RPi.GPIO as GPIO

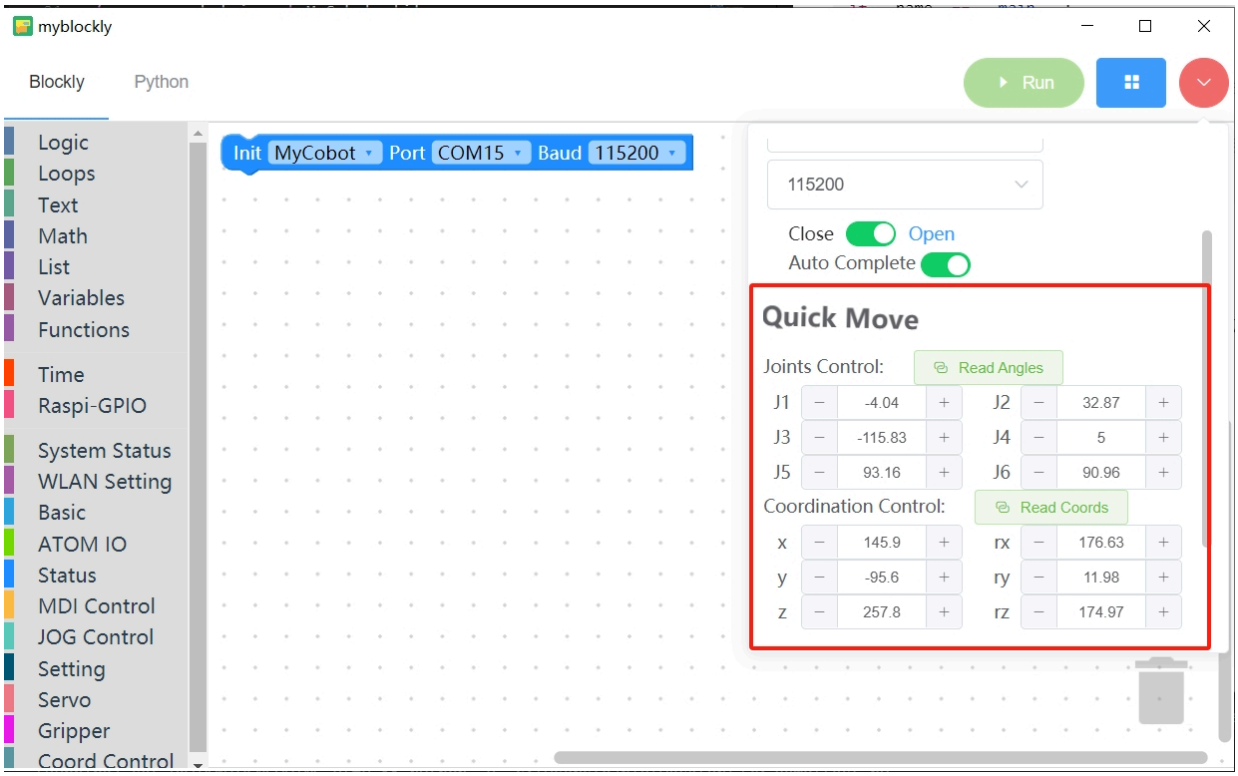
arm = MyCobot280(PI_PORT,PI_BAUD)
GPIO.setmode(GPIO.BCM)
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)
# Turn on the pump
def pump_on():
    GPIO.output(20, 0)
    time.sleep(0.05)

# Stop the pump
def pump_off():
    GPIO.output(20, 1)
    time.sleep(0.05)
    GPIO.output(21, 0)
    time.sleep(1)
    GPIO.output(21, 1)
    time.sleep(0.05)

for i in range(2):
    pump_on()
    time.sleep(2)
    pump_off()
    time.sleep(2)
```

4 Software Usage

Use the fast movement function of myblockly to teach the grabbing point and placement point of the wooden block, and record the position information. After teaching, you need to disconnect the serial port connection, otherwise the serial port will be reported when running the python script. The error is that the serial port is occupied.



5 Composite application

```
from pymycobot import MyCobot280,PI_PORT,PI_BAUD
import time
import RPi.GPIO as GPIO
init_angles=[-3.25, -2.46, -95.09, 9.22, 86.39, 93.33]#6 joint angles at the initial position
grab_point=[196.9, -197.1, 124.5, -178.8, 1.25, 173.32]#Coordinates of the grab point
place_point=[196.9, -97.1, 124.5, -178.8, 1.25, 173.32]#Coordinates of the placement point

arm = MyCobot280(PI_PORT,PI_BAUD)
GPIO.setmode(GPIO.BCM)
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)

#Turn on the pump
def pump_on():
    GPIO.output(20, 0)
    time.sleep(0.05)

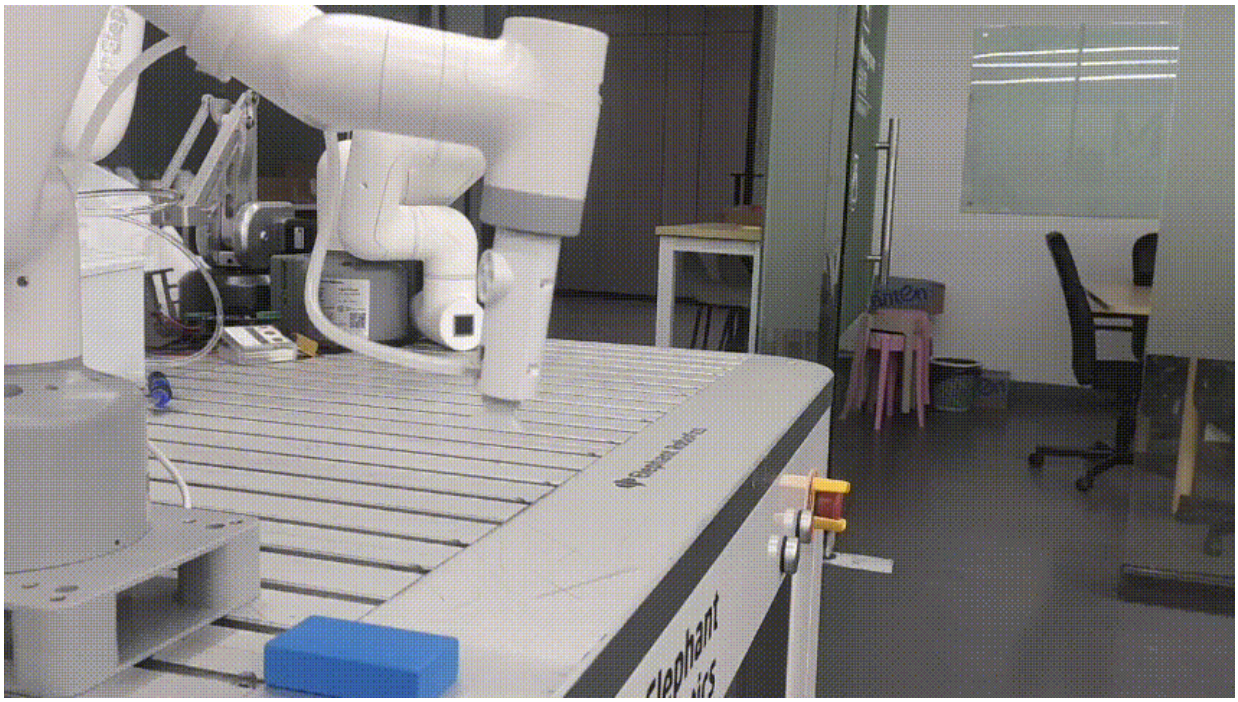
#Stop the pump
def pump_off():
    GPIO.output(20, 1)
    time.sleep(0.05)
    GPIO.output(21, 0)
    time.sleep(1)
    GPIO.output(21, 1)
    time.sleep(0.05)

if __name__=="__main__":
    pump_off()#Turn off the pump first
    time.sleep(1)
    arm.send_angles(init_angles,100)#Move to the initial position
    time.sleep(2)
    arm.send_coords([grab_point[0],grab_point[1],grab_point[2]+70,grab_point[3],grab_point[4],grab_point[5]],100,1)#Move t
    time.sleep(2)
    arm.send_coords([grab_point[0],grab_point[1],grab_point[2],grab_point[3],grab_point[4],grab_point[5]],100,1)#Move to t
    time.sleep(2)
    pump_on() #Turn on the suction pump
    time.sleep(1)
    arm.send_coords([grab_point[0],grab_point[1],grab_point[2]+70,grab_point[3],grab_point[4],grab_point[5]],100,1)#Move t
    time.sleep(2)

    arm.send_coords([place_point[0],place_point[1],place_point[2]+70,place_point[3],place_point[4],place_point[5]],100,1)#
    time.sleep(2)
    arm.send_coords([place_point[0],place_point[1],place_point[2],place_point[3],place_point[4],place_point[5]],100,1)#Mov
    time.sleep(2)
    pump_off() #Turn off the suction pump
    time.sleep(1)
```

```
    arm.send_coords([place_point[0],place_point[1],place_point[2]+70,place_point[3],place_point[4],place_point[5]],100,1)#
    time.sleep(2)
```

6 Effect display



Chapter 8 Supporting Resources

This chapter will introduce various supporting resources of the product in detail, aiming to help users fully understand and use our products efficiently. Whether it is product information, drawings, software information and source code, or system information and promotional materials, we provide detailed information and download links to ensure that users can make full use of these resources for product development, operation and promotion

Download Product Information

The product information includes detailed specifications, technical parameters and instructions for use of the 280 M5 robot arm. This section aims to help users fully understand the performance and functions of the robot arm and ensure the best experience during use

Product Drawings

The product drawings section provides detailed 3D and 2D drawings of the 280 M5 robot arm. These drawings are particularly important for engineers who need to perform customized designs or maintenance, and can help them better understand the structure of the robot arm.

Software Information and Source Code

The software information and source code section contains the software installation package, driver and related open source code that are compatible with the 280 M5 robot. Users can use these materials to install, upgrade and perform secondary development of the software to enhance the functions and application scenarios of the robot

System Information

The system information provides the system architecture and working principle of the 280 M5 robot, covering the collaborative working mode of hardware and software. This section helps users to quickly locate and solve problems during integration and debugging to ensure stable operation of the system

Promotional Materials

The promotional materials section contains the product brochure, demonstration video and customer cases of the 280 M5 robot. These materials not only show the core advantages and application scenarios of the robot, but also provide successful cases in actual applications to help potential customers understand the value of the product more intuitively.

Product Documentation Download

The product documentation includes detailed specifications, technical parameters and instructions for use of the 280 pi robotic arm. This section is intended to help users fully understand the performance and functions of the robotic arm and ensure the best experience during use

Download Link

You can download all relevant product documentation through the following link: Product Documentation Download

Operating System	Download Link
Ubuntu 18.04	Download Link
ubuntu 20.04	Download link

Product Drawings

The product drawings section provides detailed 3D and 2D drawings of the 280 pi robot arm. These drawings are particularly important for engineers who need to make customized designs or perform maintenance, and can help them better understand the structure of the robot arm.

Machine 3D Model

Machine	3D Model File
myCobot 280 PI	Download

Machine 2D Drawings

Machine	Machine 2D Drawings
myCobot 280 Atom	Download
myCobot 280PI Base	Download

Accessory 3D Model

- myCobot Series

Accessory	3D Model File
Adaptive Gripper	Download
Parallel Gripper	Download
Flexible Gripper	Download
G-type base	Download
Large suction cup base	Download
Flat base	Download
Vertical Suction Pump	Download
Double-head suction pump	Download
Camera flange	Download
Spring bamboo shoots flange	Download
Dexterous Hand	Download
Pen holder	Download
Mobile Phone Gripper	Download

Software information and source code

The software information and source code section includes the software installation package, driver and related open source code for the 280 pi robot arm. Users can use these materials to install, upgrade and perform secondary development of the software to enhance the functions and application scenarios of the robot arm

You can download all relevant product information through the following link: Software Information Download

The software download link includes the following commonly used software

- myStudio 2.0 The one-stop service platform myStudio integrates myCobot software resources and various materials. Main functions:
- Support firmware download and update;
- Provide product use video tutorials;
- Maintenance/repair information;

- RoboFlow RoboFlow is a human-computer interactive operation software developed by our company to facilitate users to quickly master the operation and use of the robot arm. Through simple operation procedures, it helps users to efficiently complete robot arm control and programming work.

- myBlockly myBlockly is a fully visual modular programming software, a graphical programming language, suitable for beginners to get familiar with programming. Users can create simple and complex functions by dragging and dropping puzzles to develop applications.

- Meta Care Meta Care is an interesting pet simulation game that combines elements such as pet raising, story and achievement collection.
- The game requires full Internet access.
- You need to own Meta Dog and connect to your device via Bluetooth.
- The game is only supported on Android devices.

- Elephant Luban Elephant Luban is a G-Code trajectory generation and use platform that provides user-based use cases, selects writing and painting, laser engraving use scenarios, and quickly opens up DIY creative space.

- MyCobot Controllerle MyCobot Controller is an APP that controls the MyCobot series of robotic arms via Bluetooth. You can use your phone to move the robotic arm. If you are an Android user, please go to [Google Play Store] If you are an IOS user, please wait for the software to be released before searching and downloading.

System Information

The system information provides the system architecture and working principle of the 280 M5 robot, covering the collaborative working mode of hardware and software. This section helps users to quickly locate and solve problems during integration and debugging to ensure stable operation of the system

(Information to be updated)

Promotional Materials

The promotional materials section includes the product brochure, demonstration video and customer cases of the 280 pi robot arm. These materials not only show the core advantages and application scenarios of the robot arm, but also provide successful cases in actual applications to help potential customers understand the value of the product more intuitively.

Machine	Product Brochure
myCobot 280 PI	Download

Product unboxing video Product unboxing video

Product promotion video Product promotion video

User Case User Case

Elephant Robotics

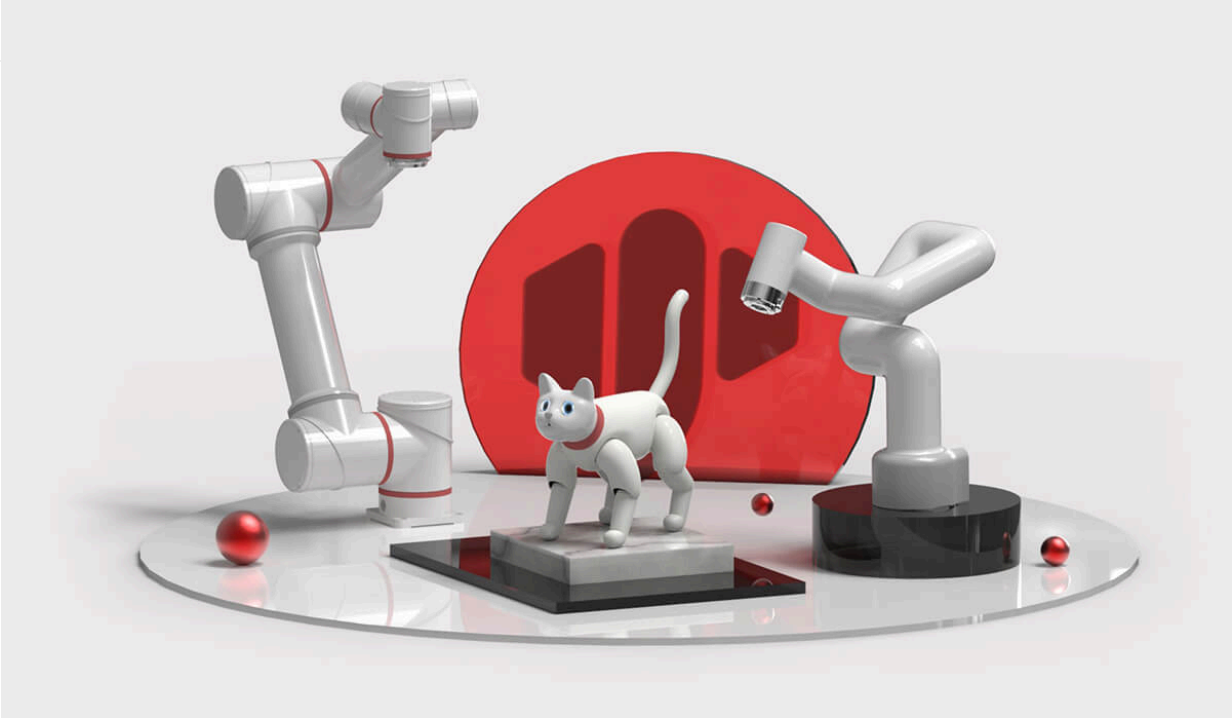
1. Company Introduction

Based in Shenzhen, China, Elephant Robotics is a high-tech enterprise focusing on robot R&D, design and automation solutions.

We are committed to providing highly flexible collaborative robots, easy-to-learn operating systems and intelligent automation solutions for robot education and scientific research institutions, commercial scenarios and industrial production. Its product quality and smart solutions have been unanimously recognized and praised by several factories from the world's top 500 companies in South Korea, Japan, the United States, Germany, Italy, Greece and other countries.

Elephant Robotics adheres to the vision of "Enjoy Robots World" and advocates the collaborative work of people and robots, making robots a good helper for human work and life, helping people to be liberated from simple, repetitive and boring work, giving full play to the advantages of human-machine collaboration, thereby improving work efficiency and helping humans create a better new life.

In the future, Elephant Robotics hopes to promote the development of the robot industry through a new generation of cutting-edge technology, and work with customers and partners to open a new era of automation and intelligence.



2. Development History

- 2016.08 -----Elephant Robotics Co., Ltd. was officially established
- 2016.08 -----Entered HAX incubator and received seed round investment from SOSV
- 2016.08 -----Started research and development of Elephant S industrial collaborative robot
- 2017.01 -----Rated as "Top 10 Most Innovative Companies in China at CES"
- 2017.04 -----Attended Hannover Industrial Fair and Korea Automation Exhibition
- 2017.07 -----Two founders were selected as "30 Business Elites Under 30" by Forbes Asia
- 2017.10 -----The fifth-generation single-arm industrial collaborative robot Elephant S was launched
- 2018.04 -----Received angel round investment from "Yun Angel Fund"
- 2018.06 -----First public appearance 2018 Hannover World Industrial Fair
- 2018.06 -----Won the "Smart Manufacturing Entrepreneurship MBA Award" from Cheung Kong Graduate School of Business
- 2018.06 -----Won the "Entrepreneurship Accelerator X-elerator Award" from Tsinghua School of Economics and Management
- 2018.11 -----Won the second place in the Shenzhen Division of the Asian Smart Hardware Competition
- 2018.11 -----Won the "Most Investment Enterprise Award" of the Gaogong Golden Globe Award
- 2019.03 -----Won the "Leadership Award" of the Gaogong Golden Globe Award
- 2019.04 -----In March 2019, Catbot won the "Industrial Robot Innovation Award"
- 2019.09 -----Attended the Huawei European Ecosystem Conference (HCE) and officially became a member of Huawei's ecological partner
- 2019.11 -----Elephant Robotics and Harbin Institute of Technology attended the IROS International Intelligent Robots and Systems Conference
- 2019.12 -----Elephant Robotics-South China University of Technology "Intelligent Robot Joint Development Laboratory" was officially unveiled
- 2019.12 -----Won the "Innovation Technology Award" of Gaogong in 2019

- 2019.12 -----Won the "Top Ten Fast-Growing Enterprises" of Gaogong in 2019
- 2019.12 -----Won the "New Enterprise Award" in the Industrial Robot Segment of Shenzhen Equipment Industry
- 2019.12 -----The world's first bionic robot cat MarsCat was launched
- 2020.05 -----The founder won the 2019 Shenzhen Robotics Newcomer Award
- 2020.10 -----The world's lightest and smallest six-axis collaborative robot myCobot was launched
- 2021.03 -----The smallest collaborative robot for scientific research myCobotPro 320 was launched
- 2021.05 -----Mars bionic cat MarsCat Received coverage from Xinhua Finance, China Daily, Nanjing Daily, Harbin Daily and other media
- 2021.07 -----Released the smallest composite robot chassis - Elephant Mobile Robot myAGV
- 2021.09 -----The world's first fully enclosed four-axis robotic arm - Elephant palletizing robotic arm myPalletizer was launched

3. Related links

Purchase link

- Taobao: https://shop504055678.taobao.com
- Shopify: https://shop.elephantrobotics.com/
- AliExpress: https://elephantrobotics.aliexpress.com/store/1101941423

Other information

- Official website: https://www.elephantrobotics.com
- Video
- Bilibili: https://space.bilibili.com/2126215657
- Youtube: https://www.youtube.com/c/Elephantrobotics
- Facebook: https://www.facebook.com/mycobotcreator/
- Linkedin: https://www.linkedin.com/company/18319865
- X (Twitter): https://twitter.com/CobotMy
- Discord: https://discord.gg/2MAherp7nt
- Hackster: https://www.hackster.io/elephant-robotics

4. Contact Us

> Our working hours are China working days, 10 am to 6 pm Beijing time.

- If you have any other questions, please contact us via the following methods. E-mail :

```
support@elephantrobotics.com
```

- If you have any purchase intention or any parameter questions, please send an email to this mailbox. [E-mail](sales@elephantrobotics.com) :

```
sales@elephantrobotics.com
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- If you encounter any problems in the use of this product, please read Chapter 9 of the manual first. If the problems listed cannot help you solve them, and you have more after-sales problems, please send an email to

this mailbox. E-mail :

```
support@elephantrobotics.com
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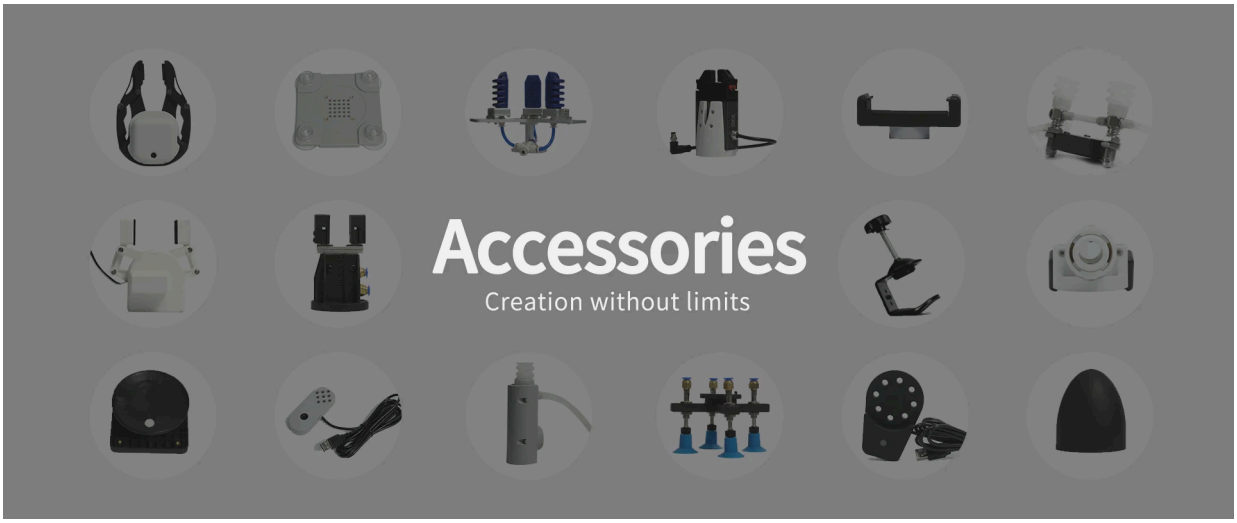
We will respond within 1-2 working days;

WeChat: We only provide one-to-one service for users who purchase mycobot products through WeChat.

← Previous Chapter | Next Chapter →

Product Accessories



In the real world, different accessories can enhance the capabilities of robots in various ways. For example, accessories such as grippers, sensors, and tools can help robots perform various tasks, thereby increasing their versatility and flexibility.

Elephant Robotics is committed to making robots and these accessories easy for everyone to use, freeing users from the complexity of choosing the right accessories and enabling them to quickly start using robots.

Accessory Types

In order to meet the needs of customers in different scenarios, we have designed various types of accessories, including grippers, suction cups, camera modules, and other gripping devices, so that users can directly choose the right end effector

Base

- Flat Base

Suitable for fixing the robot arm on a flat and smooth surface.

- G-Base

Suitable for fixing the robot arm on the edge of a table.

Gripper

- Adaptive Gripper

The gripper is a robot component that can achieve functions similar to human hands. It has the advantages of complex structure, firm gripping of objects, not easy to fall, and easy operation. The gripper kit includes gripper accessories and Lego technology parts. The end effector of the robot arm is controlled by a programmable system to achieve functions such as object grasping and multi-point positioning.

- Parallel Gripper

Driven by a motor, the finger surface of the gripper makes a linear reciprocating motion to achieve the opening or closing action. The acceleration and deceleration of the electric gripper can be controlled, the impact on the workpiece can be minimized, the positioning point can be controlled, and the clamping can be controlled

- Flexible Gripper-Open Foot Type

The fingertips are made of rubber and rely on air pressure deformation to grasp objects. Pneumatic manipulators are widely used and are favored for their softness, adaptability and efficiency. These advantages make them powerful tools in automation and robotic applications, capable of effectively handling a wide range of objects and tasks

Suction Pumps

- Vertical Suction Pumps

With one suction nozzle and one exhaust nozzle, the suction pump kit is controlled as the end effector of the robot arm to perform the function of sucking objects.

- Double-head Suction Pumps

Compared with single-head suction pumps, it is more stable, with simple structure, small size, easy to use, low noise, and good self-priming ability.

- Integrated Suction Pumps

The integrated suction pump has the advantages of simple structure, small size, easy to use, low noise, and good self-priming ability.

Holder

- Pen Holder

The overall solid color design can be used for writing, drawing and other applications.

- Phone Holder

Suitable for devices that require physical clamping, such as photography, and can clamp a variety of mobile phones. It has a simple structure and is easy to install and disassemble.

Other functional accessories

- Dexterous Hand

A robot component that can achieve functions similar to human hands. It has the advantages of a complex structure, firm gripping of objects, not easy to fall, and easy operation. The gripper kit includes gripper accessories and Lego technology parts. The end effector of the robot arm is controlled by a programmable system to achieve functions such as object grasping and multi-point positioning.

- USB Camera

The USB high-definition camera can be used with suction pumps, adaptive grippers, artificial intelligence kits, etc., and eye in hand can achieve precise positioning and calibration.

- Bamboo Flange

Suitable for devices with physical travel such as click buttons and keyboards. The overall solid color design, simple structure, and easy installation and disassembly.

Flat base

Applicable models: myCobot 280

Specifications:

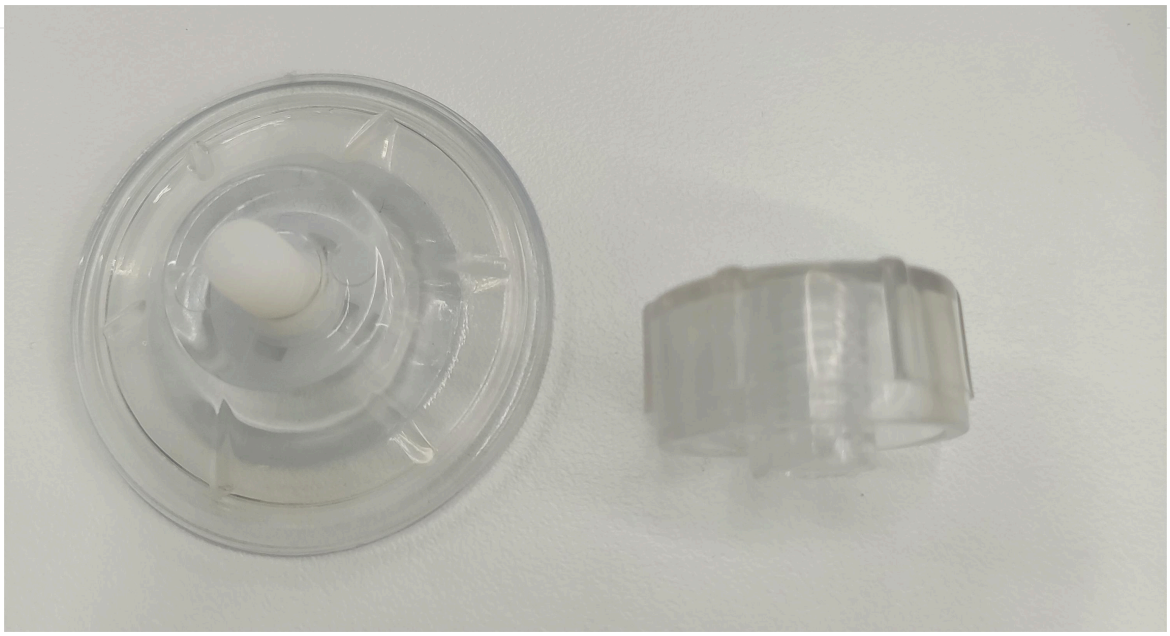
Name	Flat base
Model	myCobot_Fstand_grey
Color	Gray, black
Process	ABS compression molding
Size	145×145×13
Weight	60g
Fixed	Lego connector/screw fixation
Environment requirements	Normal temperature and pressure
Applicable equipment Fit	ER myCobot 280 M5, ER myCobot 280 Pi

Instructions for use:

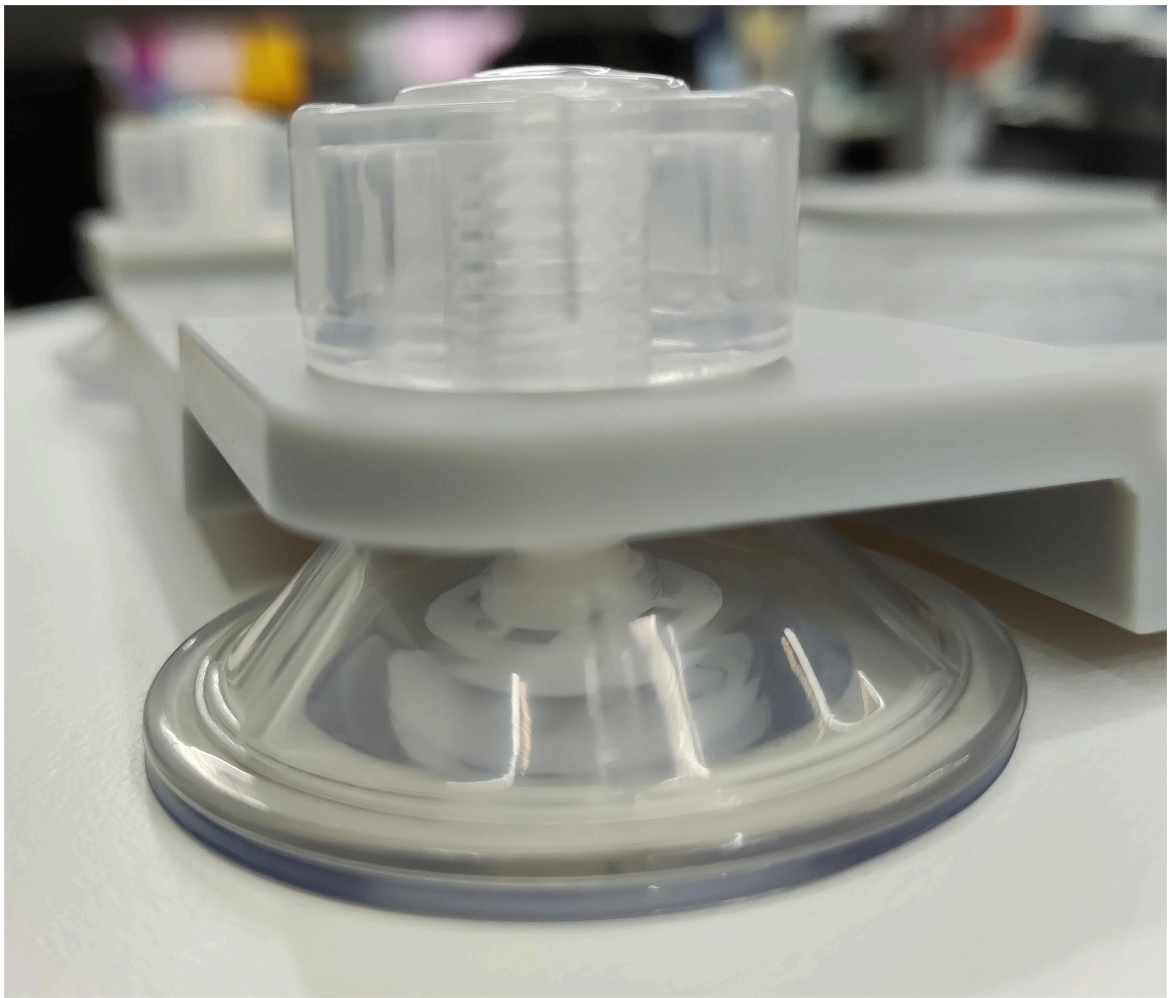
Applicable to flat and smooth surfaces

- 1. Install the suction cups at the four corners of the base and tighten them.
- 1. Use the included Lego tech parts to connect the flat base and the bottom of the robot arm.
- 1. Fix the four suction cups on a flat and smooth surface before starting to use.

Remove the nut:



Tighten through the holes at the four corners:



> Adjust the number of Lego connectors as needed. It is recommended to use a sufficient number of connectors to ensure the stability of the machine:

Tips

You can add a small amount of **non-conductive** liquid under the suction cup to fill the gap between the suction cup and the desktop to obtain the best adsorption effect.


myCobot

G-type stand 2.0

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Specifications:

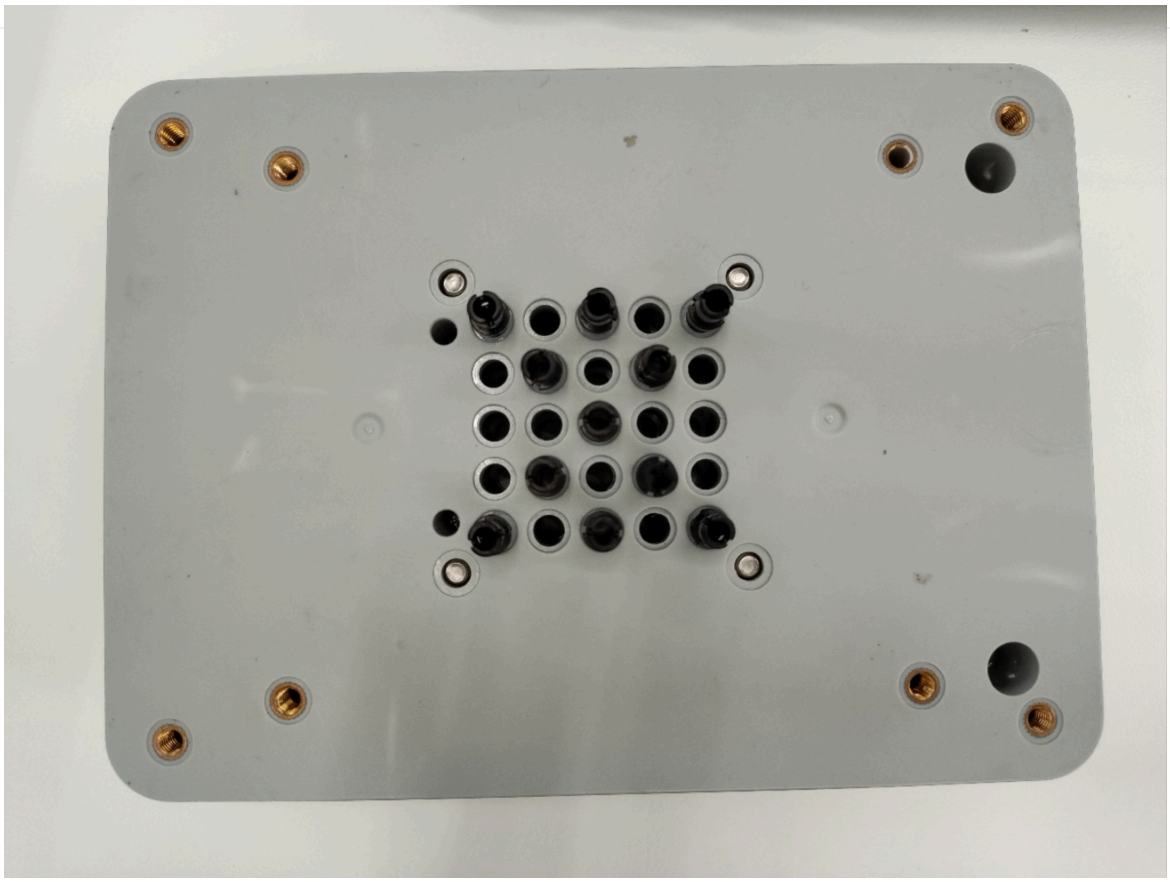
Name	G-type stand 2.0
Model	myCobot_Gstand_grey_V2
Color	Gray, black
Process	ABS compression molding
Size	174.8x166x31
Fixed	Lego connector/screw fixation
Environment requirements	Normal temperature and pressure
Applicable equipment Fit	ER myCobot 280 series, ER myPalletizer 260 series, mecharm 270 series, myBuddy 280 series

Instructions:

G-type base - fixed to the edge of the table

- 1. Use the G-shaped clamp to fix the base to the edge of the table
- 1. Use the included Lego connector to connect the base and the bottom of the robot arm
- 1. Make sure it is stable before starting to use

Insert the Lego connector as needed



Adaptive gripper

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Product image

Specifications:

Name	mycobot280 Adaptive Gripper
Model model	myCobot_gripperAg_white
Process	ABS injection molding
Color	White
Gripping range	20-45mm
Maximum gripping force	150g
Repeatability	1mm
Service life	One year
Drive mode	Electric
Transmission mode	Gear + connecting rod
Dimensions	112×94×50mm
Weight	110g
Fixing method	Lego connector
Environment requirements	Normal temperature and pressure
Control interface	Serial control
Applicable equipment	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Adaptive gripper: Used to grip objects

Introduction

- The gripper is a robot component that can achieve functions similar to human hands. It has the advantages of complex structure, firm gripping of objects, not easy to fall, and easy operation. The gripper kit includes gripper accessories and Lego technology parts. The end effector of the robot arm is controlled by a programmable system to realize functions such as object gripping and multi-point positioning. The gripper can be used in all development environments, such as ROS, Arduino, Roboflow, etc.

Working Principle

- Driven by a motor, the gripper's finger surface makes linear reciprocating motion to achieve opening or closing. The acceleration and deceleration of the electric gripper are controllable, the impact on the workpiece can be minimized, the positioning point is controllable, and the clamping is controllable.

Applicable objects

- Small cubes
- Small balls
- Long objects

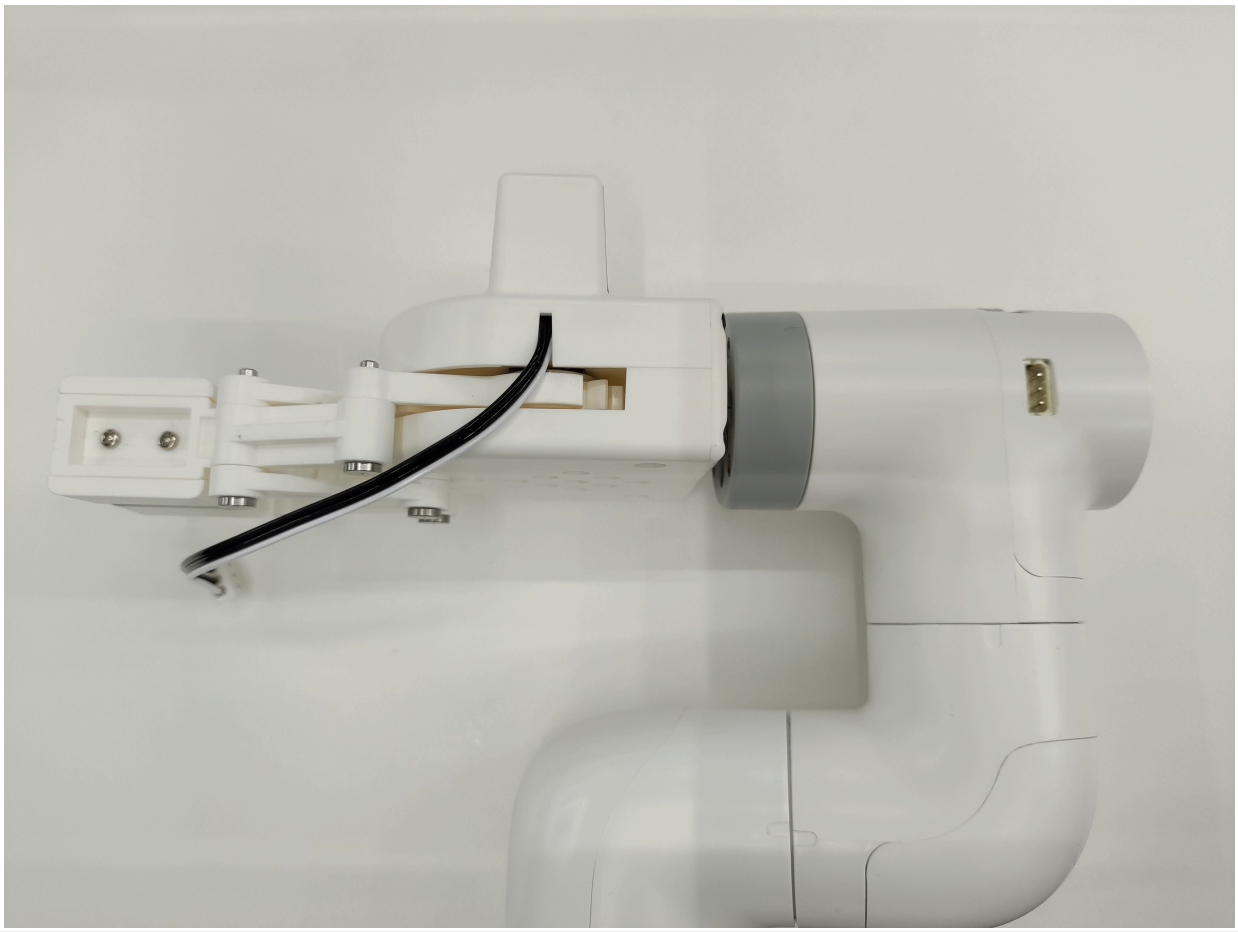
Installation and use

- Check whether the accessories package is complete: Lego connectors, grippers with connecting wires, and connecting wire extension wires

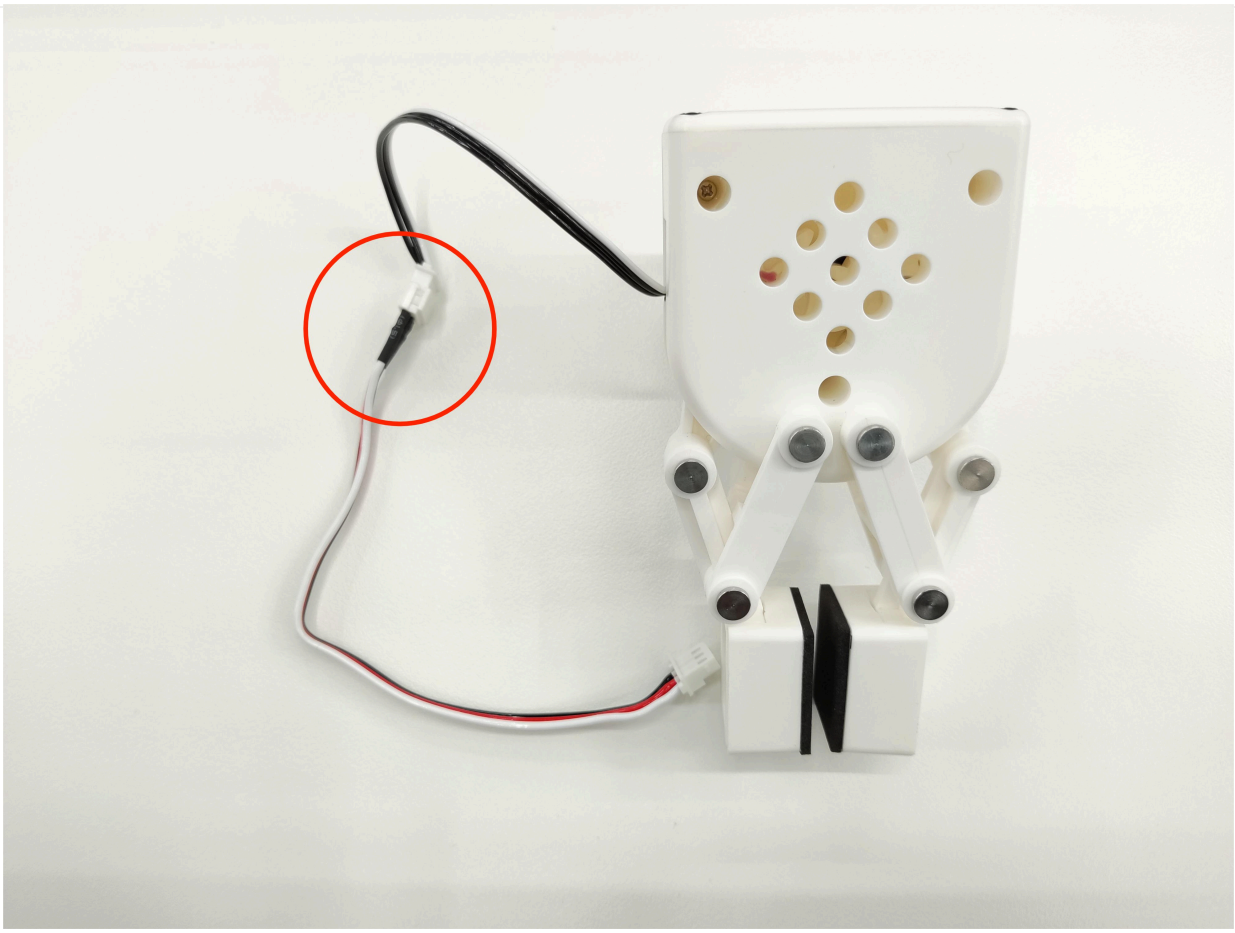
- Gripper installation:
- Structural installation:

Insert the Lego connector into the socket reserved for the gripper. You can choose two different directions for installation as needed:

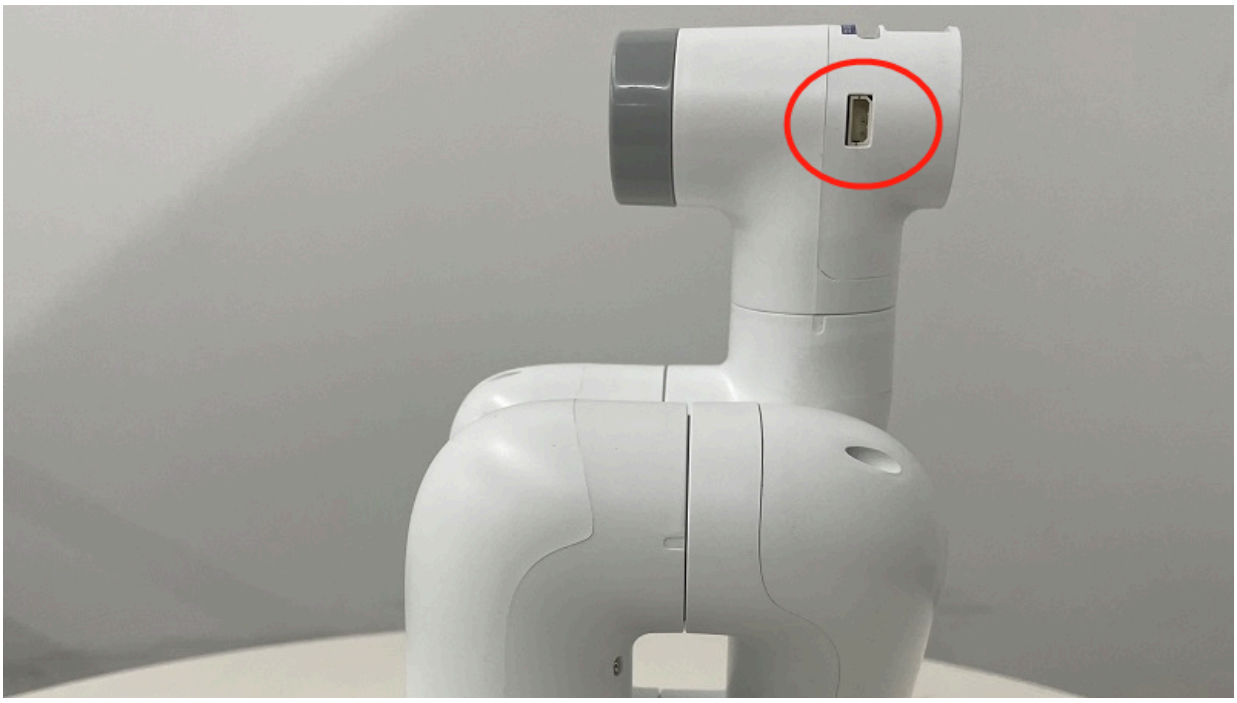
Align the gripper with the connector inserted into the socket at the end of the robot arm and insert it:

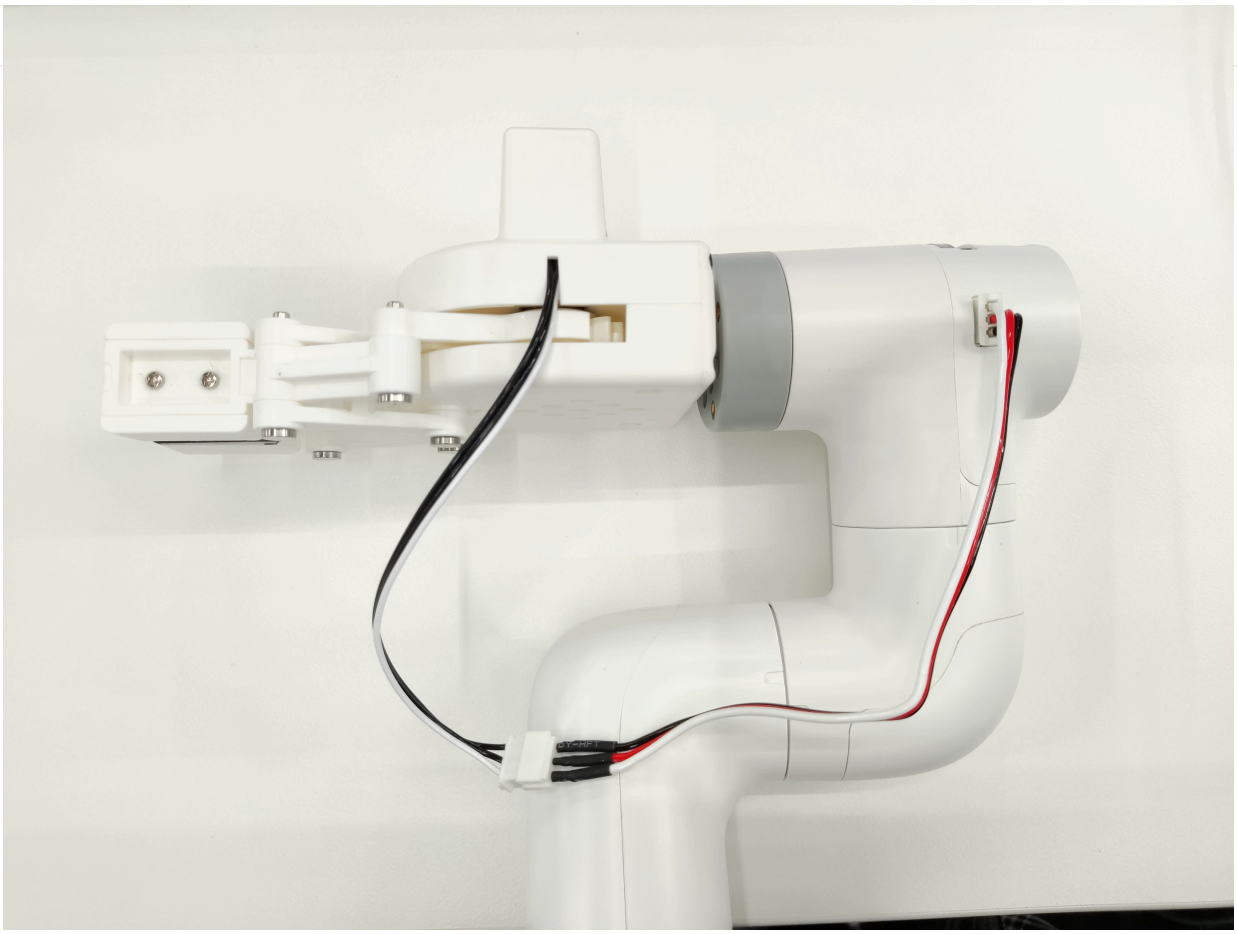


- Electrical connection Connect the extension cord to the gripper:



Insert the robot control interface:





Programming development:

> Use python to program the gripper

- M5 version:

```
from pymycobot import MyCobot280
import time


# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)

# The following three methods can control the gripper to open-close-open
# Method 1:
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(1, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)

# Method 2:
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# mc.set_gripper_value(0, 80)
# time.sleep(3)
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# Method three:
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
# mc.set_encoder(7, 1500, 20)
# time.sleep(3)
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
```

- Pi version:

```
from pymycobot import MyCobot280
from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two varia
import time

# Initialize a MyCobot280 object
mc = MyCobot280(PI_PORT, PI_BAUD)

# The following three methods can control the gripper to open-close-open
# Method 1:
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(1, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)
# Method 2:
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# mc.set_gripper_value(0, 80)
# time.sleep(3)
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# Method 3:
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
# mc.set_encoder(7, 1500, 20)
# time.sleep(3)
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
```

Save the file and close it. Return to the command line terminal and enter:

```
python grip.py
```

> You can see the gripper open-close-open

Parallel gripper

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Product image

Specifications:

Name	mycobot280 parallel gripper
Model model	myCobot_gripper_parallel
Process	ABS injection molding
Color	White
Gripping range	<20mm (effective 15mm)
Maximum gripping force	150g
Repeatability	1mm
Service life	One year
Drive mode	Electric
Transmission mode	Gear + connecting rod
Dimensions	66×78×46mm
Weight	84g
Fixing method	Lego connector
Environment requirements	Normal temperature and pressure
Control interface	Serial control
Applicable equipment	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Parallel gripper: Used to grip objects

Introduction

- The gripper is a robot component that can achieve functions similar to human hands. It has the advantages of complex structure, firm gripping of objects, not easy to fall, and easy operation. The gripper kit includes gripper accessories and Lego technology parts. The end effector of the robot arm is controlled by a programmable system to realize functions such as object gripping and multi-point positioning. The gripper can be used in all development environments, such as ROS, Arduino, Roboflow, etc.

Working Principle

- Driven by a motor, the gripper's finger surface makes linear reciprocating motion to achieve opening or closing. The acceleration and deceleration of the electric gripper are controllable, the impact on the workpiece can be minimized, the positioning point is controllable, and the clamping is controllable.

Applicable objects

- Small cubes
- Small balls
- Long objects

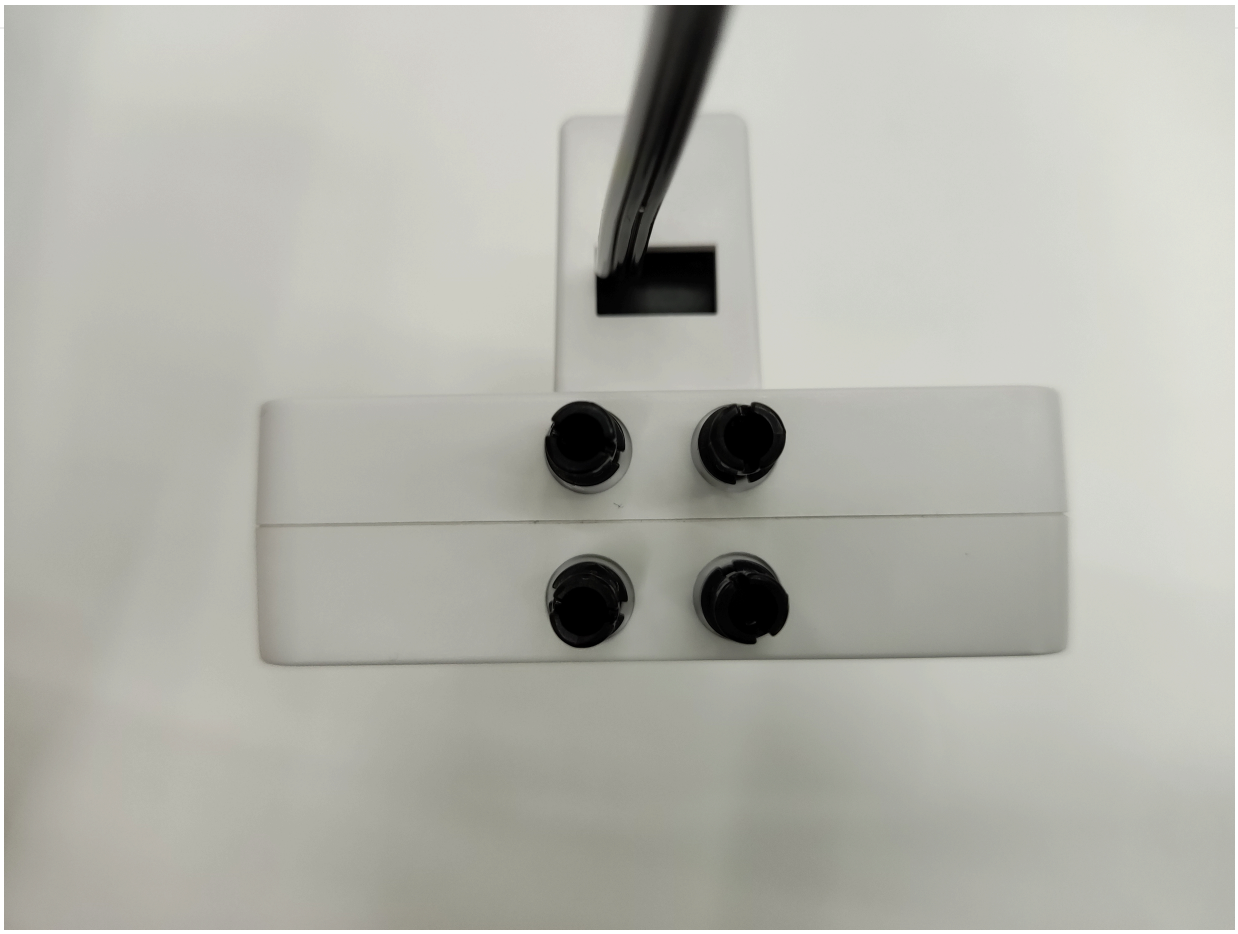
Installation and use

- Check whether the accessories package is complete: Lego connectors, grippers with connecting wires

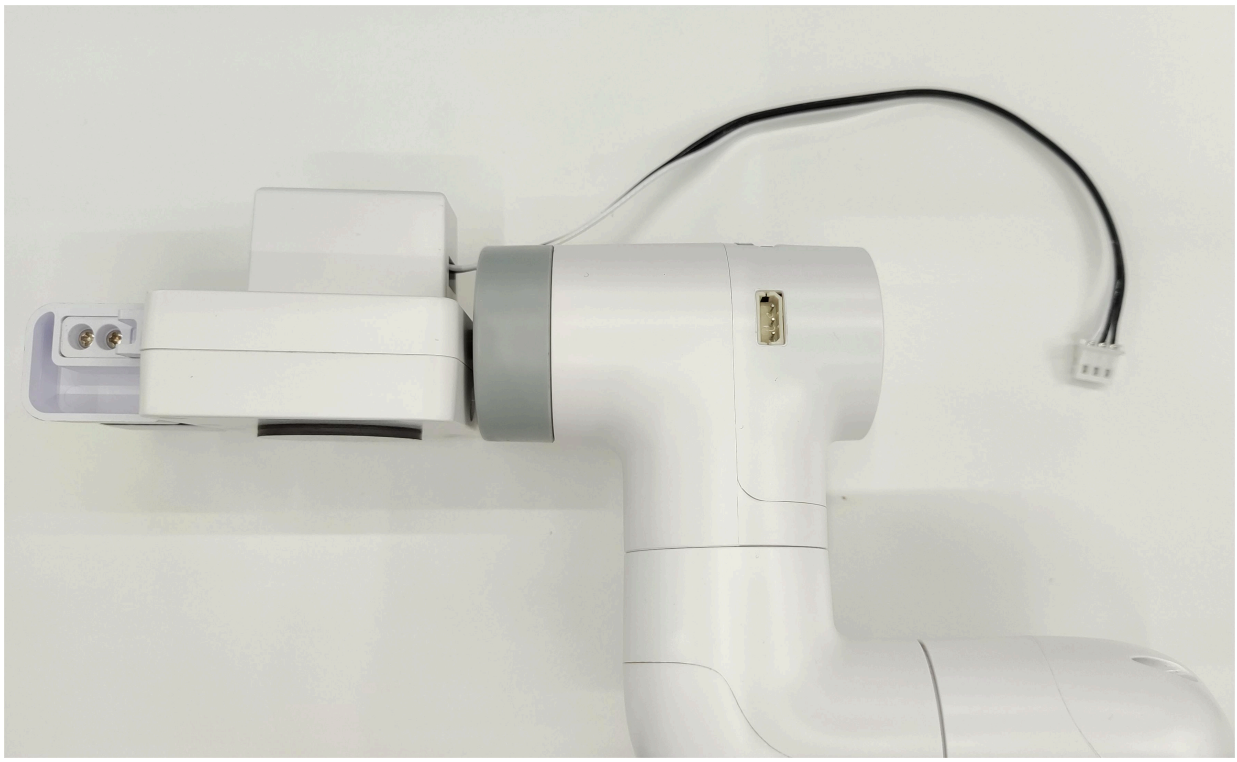
- Gripper installation:

Structural installation:

Insert the Lego connector into the reserved socket of the gripper:

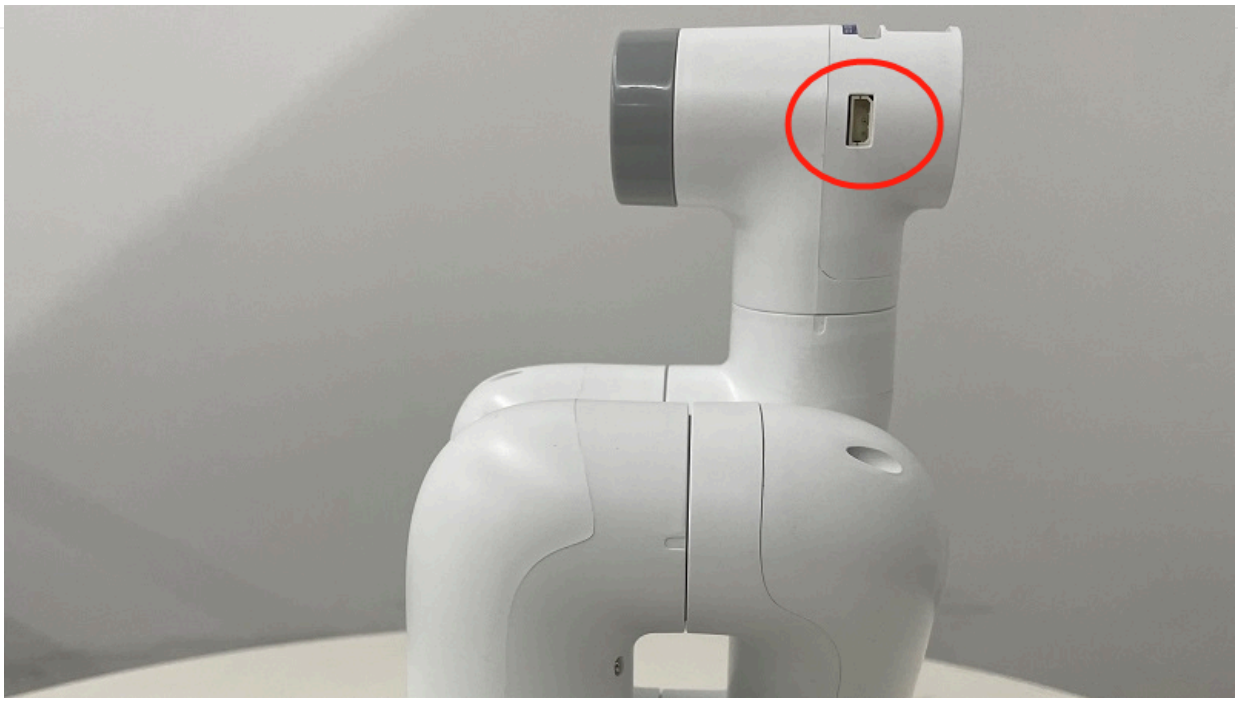


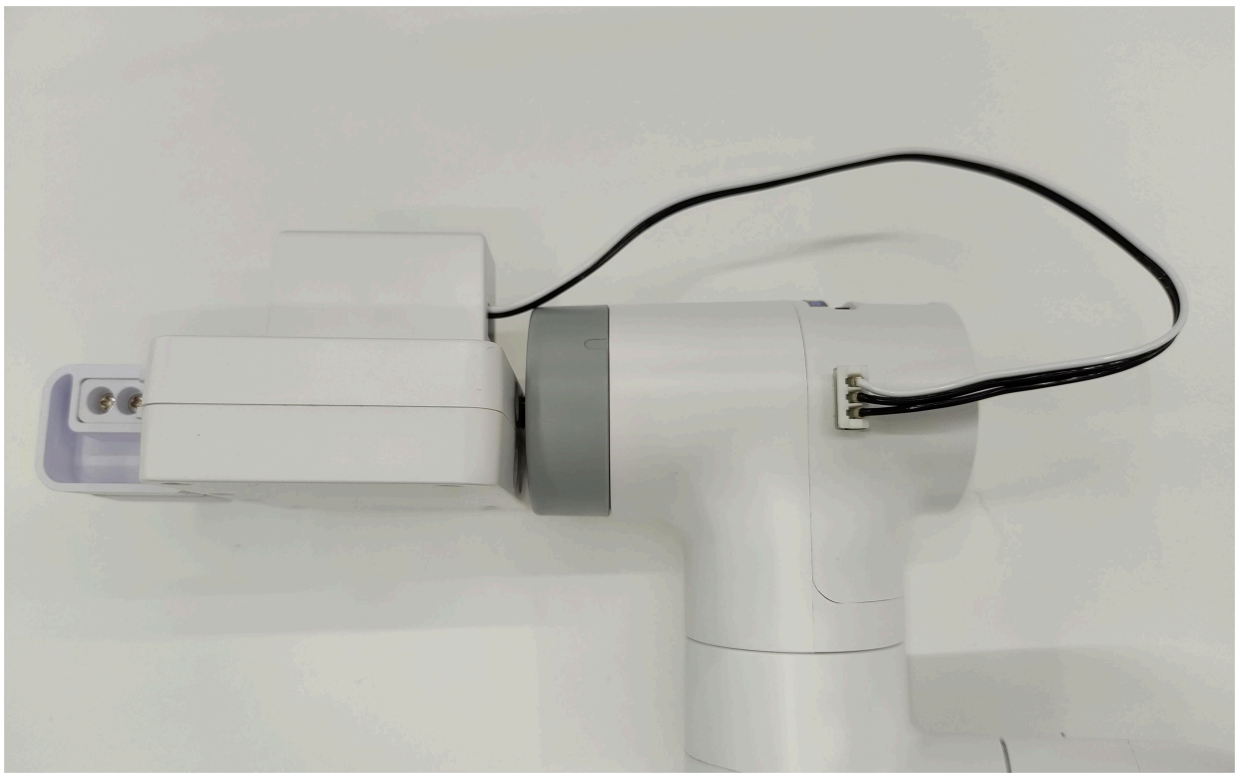
Align the gripper with the connector inserted into the socket at the end of the robot arm and insert it:



Electrical connection:

Insert the robot arm control interface:





Programming and development:

> Use python to program the gripper

- M5 version:

```
from pymycobot import MyCobot280
import time

# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)

# The following three methods can control the gripper to open-close-open
# Method 1:
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(1, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)

# Method 2:
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# mc.set_gripper_value(0, 80)
# time.sleep(3)
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# Method three:
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
# mc.set_encoder(7, 1500, 20)
# time.sleep(3)
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
```

- Pi version:

```
from pymycobot import MyCobot280
from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two varia
import time

# Initialize a MyCobot280 object
mc = MyCobot280(PI_PORT, PI_BAUD)

# The following three methods can control the gripper to open-close-open
# Method 1:
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(1, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)

# Method 2:
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# mc.set_gripper_value(0, 80)
# time.sleep(3)
# mc.set_gripper_value(100, 80)
# time.sleep(3)

# Method 3:
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
# mc.set_encoder(7, 1500, 20)
# time.sleep(3)
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
```

Save the file and close it, return to the command line terminal, and enter:

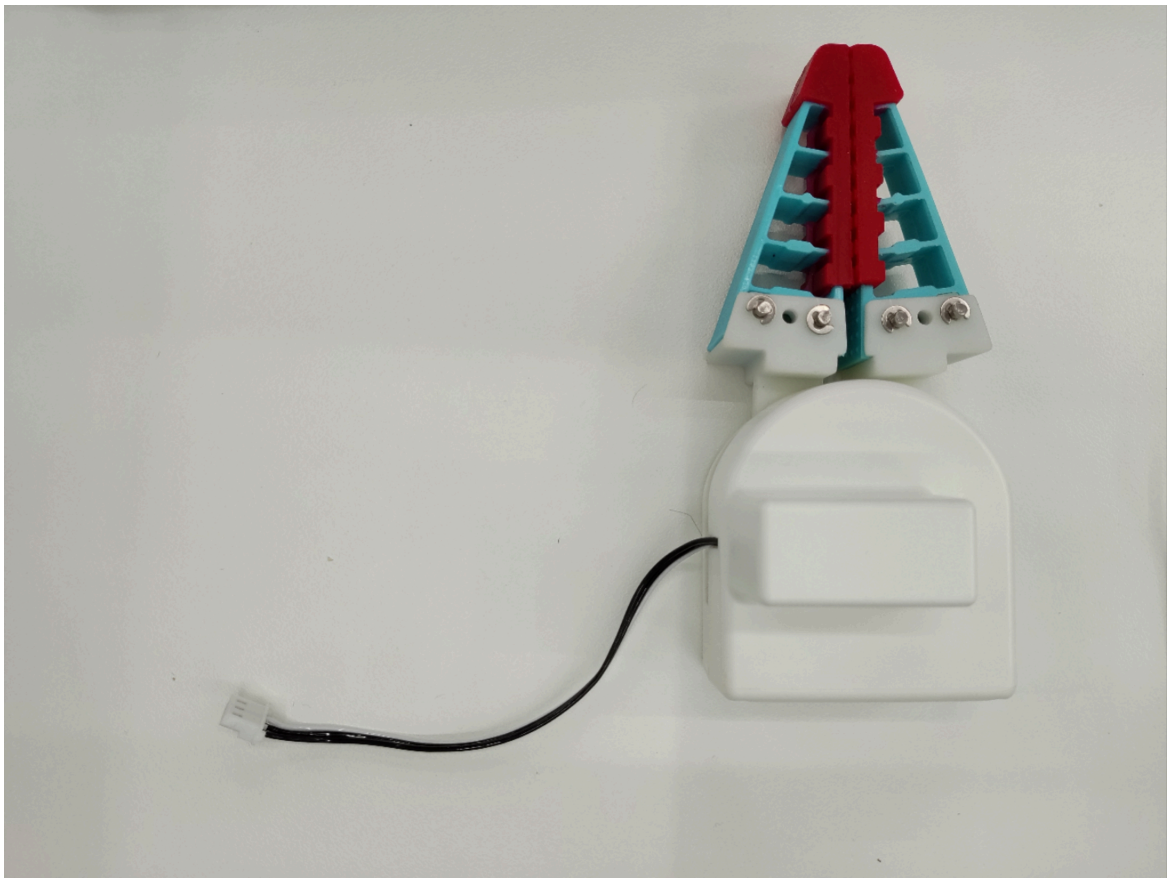
```
python grip.py
```

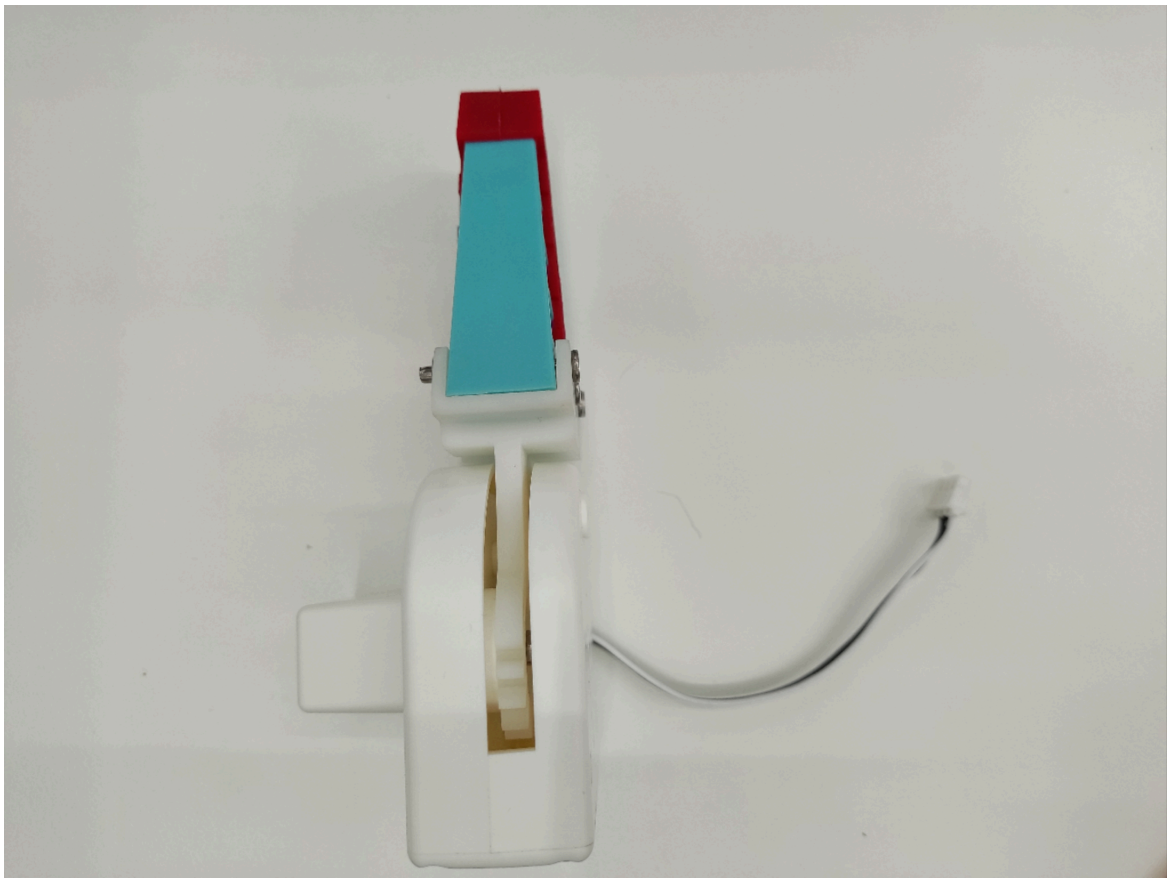
> You can see the gripper open-close-open

Flexible Gripper - Open-leg Type

Applicable models: myCobot 280, myPalletizer 260, mechArm 270, myBuddy 280

Product Image





Specifications:

Name	mycobot280 Open-leg Gripper
Model model	myCobot Open-leg Gripper
Process	Photosensitive resin
Color	White
Repeatability	±1mm
Service life	One year
Drive mode	Electric
Fixing mode	Lego connector
Environmental requirements	Normal temperature and pressure
Control interface	Serial control
Applicable equipment	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Flexible gripper: Used to grip objects

Introduction

- Traditional industrial suction cups need to suck the flat surface of the material. In more and more working conditions, the suction surface is easy to damage the panel or components. The soft-touch gripper grabs the edge and easily transports the panel without marks or damage, ensuring that the product surface is flawless and improving the yield rate.
- The modular design of the soft-touch gripper is light in weight and can be freely arranged and combined according to the size of the panel.
- The clamping force of traditional cylinders is generally large, and the force is difficult to control. The edge of the clamped panel is easy to be clamped and warped. The single-finger clamping force of the flexible gripper is precisely controllable and will not clamp fragile workpieces.

Working Principle

- The flexible gripper is an innovative bionic flexible gripper developed by researchers imitating the shape of the arms and legs of a starfish. The "fingers" of the soft gripper are made of flexible polymer silicone material, which can bend and deform by inflation. It can adaptively wrap around the target object like a starfish, and can complete the flexible and non-destructive grasping of irregular and fragile objects.

Applicable objects

- Any object of any shape within a reasonable size

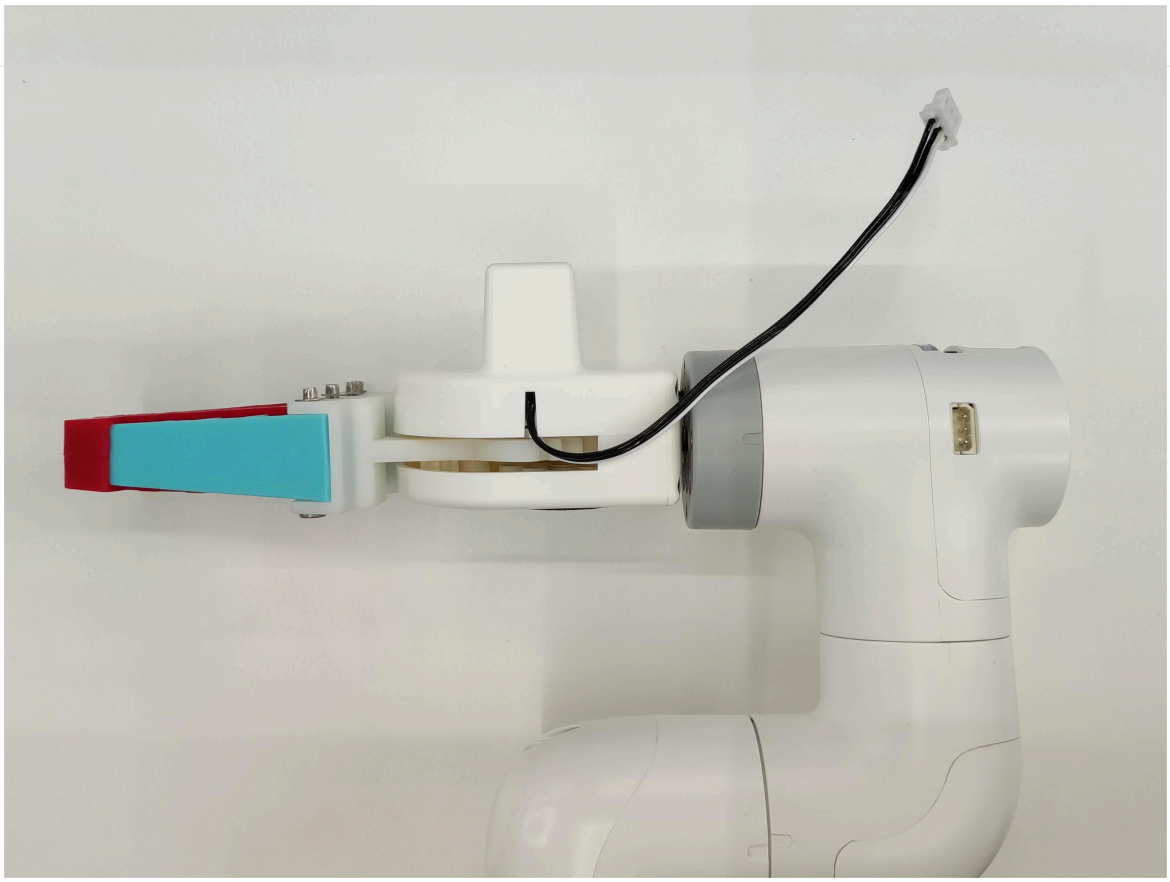
Installation and use

- Check whether the accessories package is complete: Lego connector, gripper with connecting wire, extension wire

- Gripper installation:

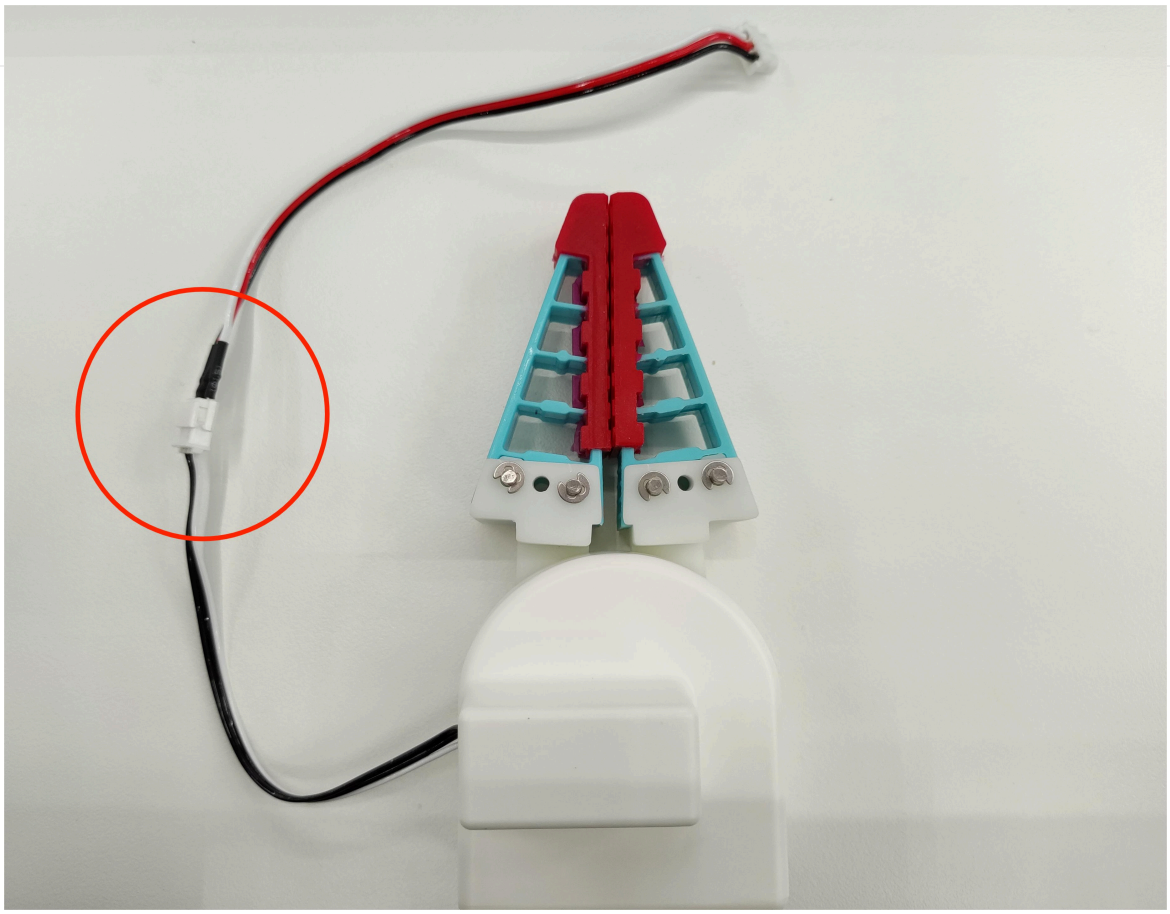
Structural installation: Insert the Lego connector into the reserved socket of the gripper. You can choose two different directions for installation as needed:

Align the gripper with the connector inserted into the socket at the end of the robot arm and insert it:

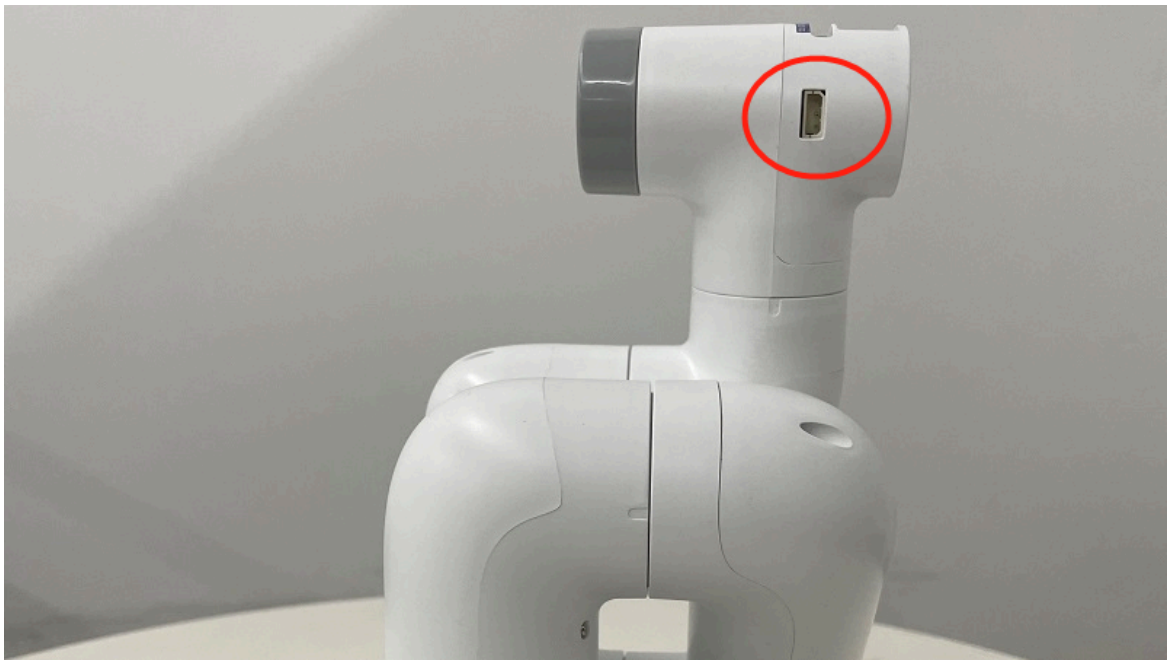


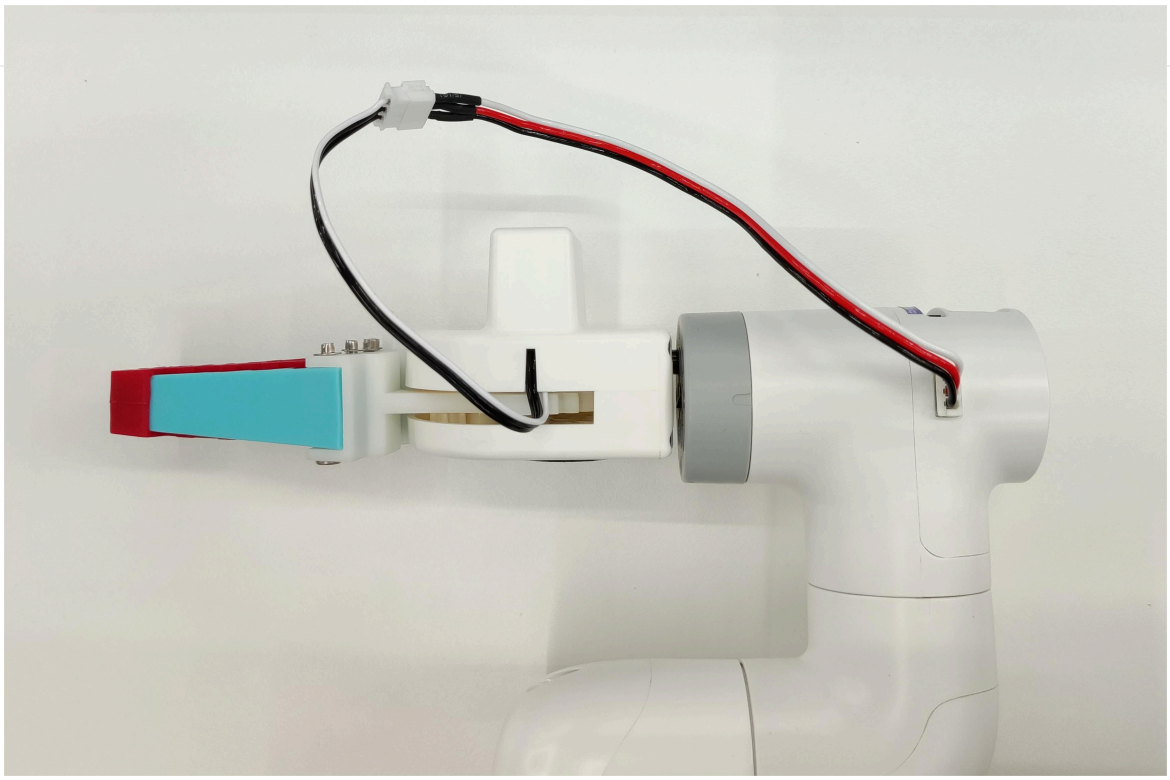
- Electrical connection:

Connect the extension wire to the gripper:



Insert the robot control interface:





Programming development

- M5 version:

```
from pymycobot import MyCobot280
import time


# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)

# The following three methods can control the gripper to open-close-open
# Method 1:
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(1, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)

# Method 2:
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# mc.set_gripper_value(0, 80)
# time.sleep(3)
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# Method three:
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
# mc.set_encoder(7, 1500, 20)
# time.sleep(3)
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
```

- Pi version:

```
from pymycobot import MyCobot280
from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two varia
import time

# Initialize a MyCobot280 object
mc = MyCobot280(PI_PORT, PI_BAUD)

# The following three methods can control the gripper to open-close-open
# Method 1:
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(1, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)
mc.set_gripper_state(0, 80)
time.sleep(3)
# Method 2:
# mc.set_gripper_value(100, 80)
# time.sleep(3)
# mc.set_gripper_value(0, 80)
# time.sleep(3)
# mc.set_gripper_value(100, 80)
# time.sleep(3)

# Method 3:
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
# mc.set_encoder(7, 1500, 20)
# time.sleep(3)
# mc.set_encoder(7, 2048, 20)
# time.sleep(3)
```

Save the file and close it, return to the command line terminal, and enter:

```
python grip.py
```

> You can see the gripper open-close-open

Vertical Suction Pump V2.0

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Product Image

Specifications

Name	myCobot Vertical Suction Pump V2.0
Model	myCobot_suctionPump_V2.0_grey
Material	ABS injection molding
Color	White
Dimensions	Suction Pump Box: 72x52x37 Suction Pump End: 63x24.5x26.7
Number of Suction Cups	1
Suction Cup Size	Diameter 20mm
Suction Weight	150g
Power Source Equipment	Suction pump box
Service life	One year
Fixing method	Lego connector
Control interface	IO control
Use environment requirements	Normal temperature and pressure
Applicable equipment	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Suction pump: Used for adsorbing objects

Introduction

- Suction pump, that is, vacuum adsorption pump, has one suction nozzle and one exhaust nozzle. It has the advantages of simple structure, small size, easy use, low noise, and good self-priming ability. By controlling the suction pump kit as the end effector of the robot arm, the function of adsorbing objects is performed.
- Suction pump accessories: power cord x1, Dupont wire x10, one-input and two-output connection wire x1, several Lego tech parts

Working principle

- When sucking objects: the air pump starts to suck air and adsorbs the objects and then stops, and there will be no air leakage in a short time.
- When putting down the objects: the electronic valve starts, the air release valve opens, and air enters the vacuum suction cup to separate from the sucked objects.

Applicable objects

- Paper/plastic sheets
- Flat and smooth objects
- Cards, etc.

Installation and use

- Check whether the accessories package is complete: Lego connectors, Dupont wires, double-head suction pump

- Double-head suction pump installation:

Structural installation:

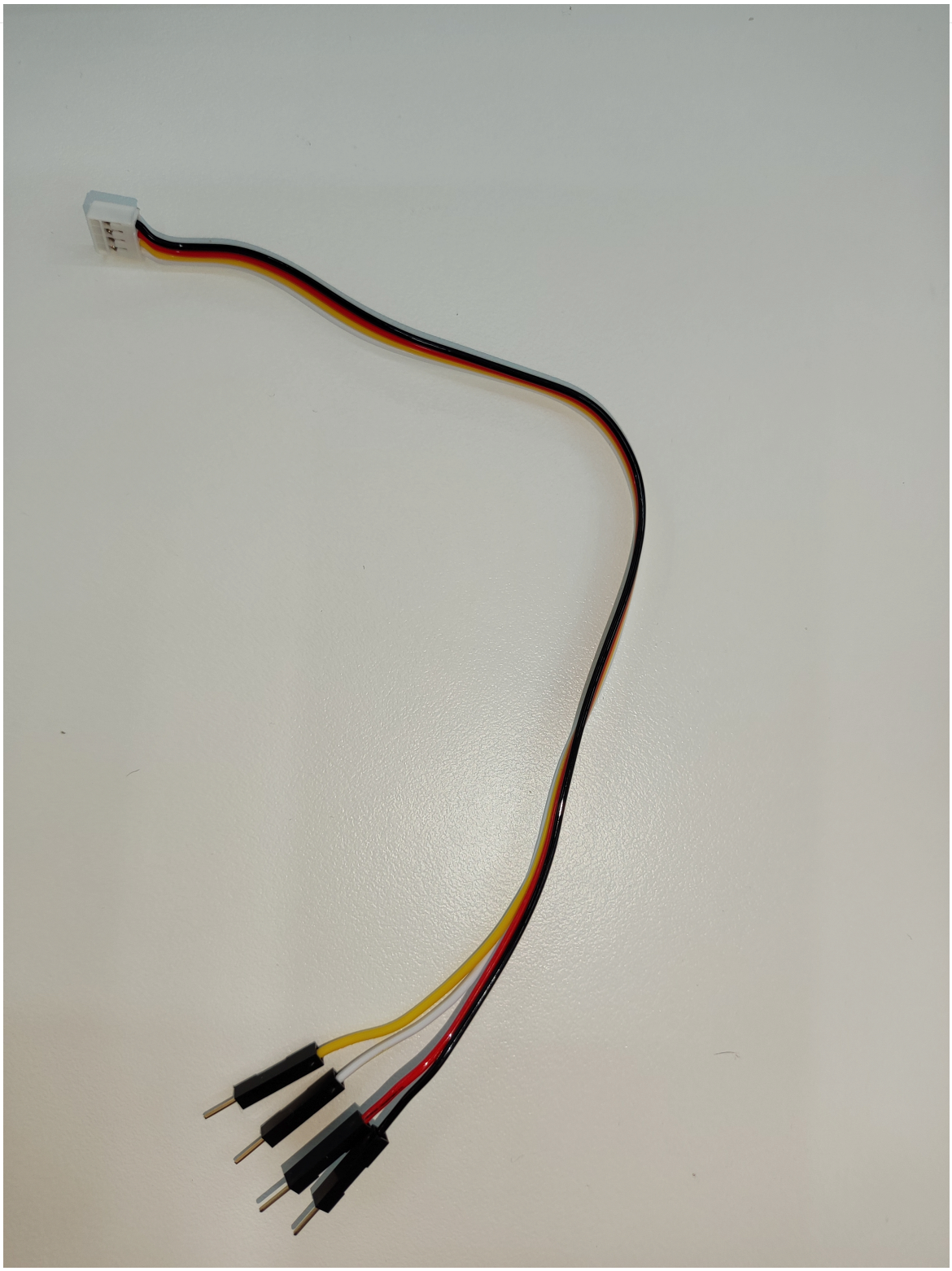
Insert the Lego connector into the reserved socket on the suction pump:

Align the suction pump with the connector plugged in with the socket at the end of the robotic arm and insert it:

- Electrical connection:

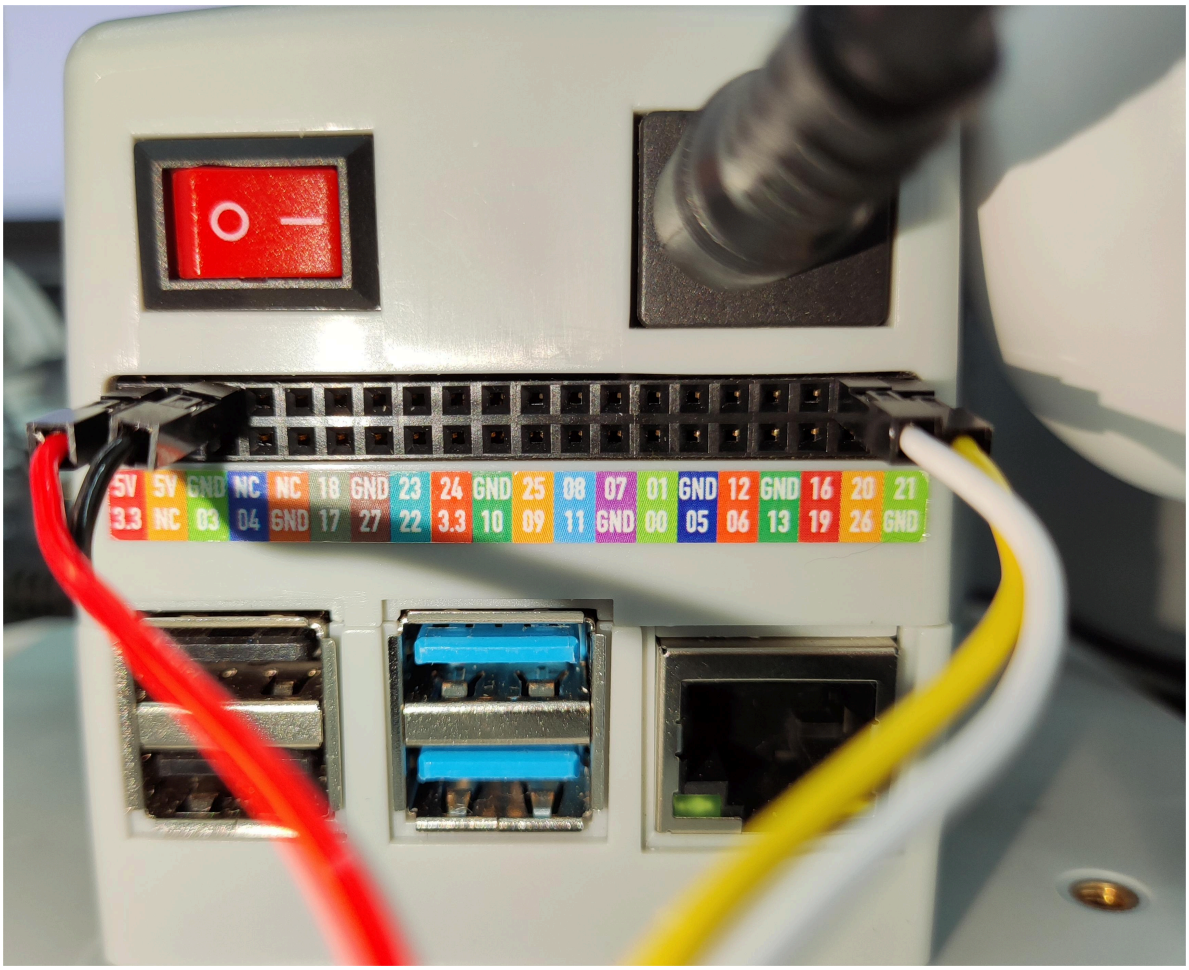
Select the male-female DuPont wire and insert the female end into the socket marked with pins on the suction pump box:

Male-female DuPont wire:



Note the correspondence between the DuPont wire colors and pins in the figure:

1. Insert the male end into the robot base pin according to the given correspondence:



> The left side is the suction pump pin and the right side is the robot pin GND -> GND 5V -> 5V G2 -> 21 G5 -> 20

- Programming development:

  > Use python to program the suction pump

> The code is as follows:

- 280-M5 version:

```
from pymycobot import MyCobot280
import time

# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)

# Turn on the suction pump
def pump_on():
# Open the solenoid valve
mc.set_basic_output(5, 0)
time.sleep(0.05)

# Stop the suction pump
def pump_off():
# Close the solenoid valve
mc.set_basic_output(5, 1)
time.sleep(0.05)
# The deflation valve starts working
mc.set_basic_output(2, 0)
time.sleep(1)
mc.set_basic_output(2, 1)
time.sleep(0.05)

pump_off()
time.sleep(3)
pump_on()
time.sleep(3)
pump_off()
time.sleep(3)
GPIO.cleanup() # Release pin channel
```

- 280-Pi version:

```
from pymycobot import MyCobot280
from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two varia
import time
import RPi.GPIO as GPIO

# Initialize a MyCobot280 object
mc = MyCobot280(PI_PORT, PI_BAUD)

# Initialize
GPIO.setmode(GPIO.BCM)
# Pins 20/21 control the solenoid valve and the deflation valve respectively
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)

# Turn on the suction pump
def pump_on():
# Open the solenoid valve
GPIO.output(20, 0)

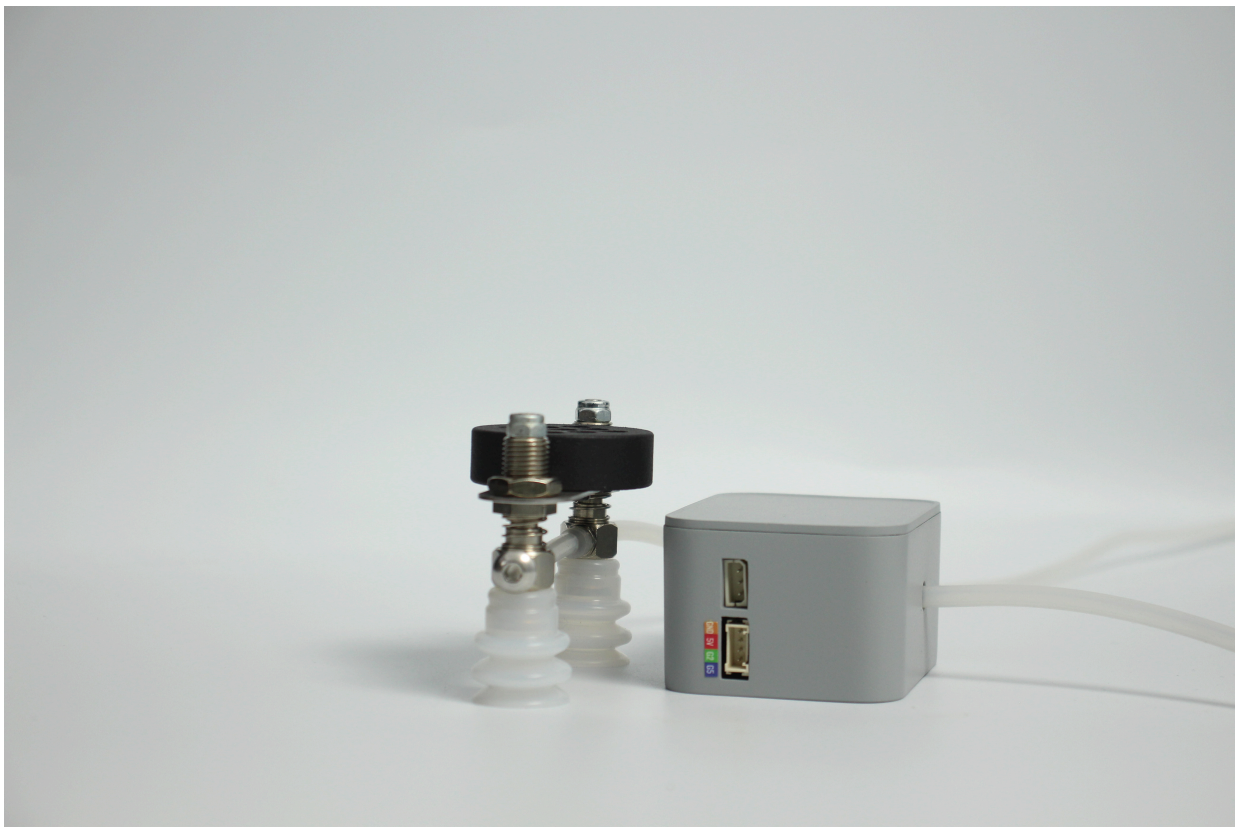
# Stop the suction pump
def pump_off():
# Close the solenoid valve
GPIO.output(20, 1)
time.sleep(0.05)
# Open the deflation valve
GPIO.output(21, 0)
time.sleep(1)
GPIO.output(21, 1)
time.sleep(0.05)

pump_off()
time.sleep(3)
pump_on()
time.sleep(3)
pump_off()
time.sleep(3)
GPIO.cleanup() # Release the pin channel
```

Dual-head suction pump

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Product image



Specifications

Name	Dual-head suction pump
Model	myCobot_DualPump_grey
Material	Photosensitive resin/nylon 7100
Color	White+black
Size	Pump end: 63x24.5x26.7
Number of suction cups	2
Suction cup size	Diameter 20mm
Suction weight	150g
Power source equipment	Pump box
Service life	One year
Fixing method	Lego connector
Control interface	IO control
Environment requirements	Normal temperature and pressure
Applicable equipment	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Suction pump: Used for adsorbing objects

Introduction

- Suction pump, that is, vacuum adsorption pump, has two suction nozzles and two exhaust nozzles for one inlet and one outlet. It is more stable than single-head suction pump. It has the advantages of simple structure, small size, easy use, low noise, and good self-priming ability. By controlling the suction pump kit as the end effector of the robot arm, the function of adsorbing objects is performed.
- Suction pump accessories: power cord x1, DuPont line x10, one-input and two-output connection line x1, Lego technology parts x several

Working principle

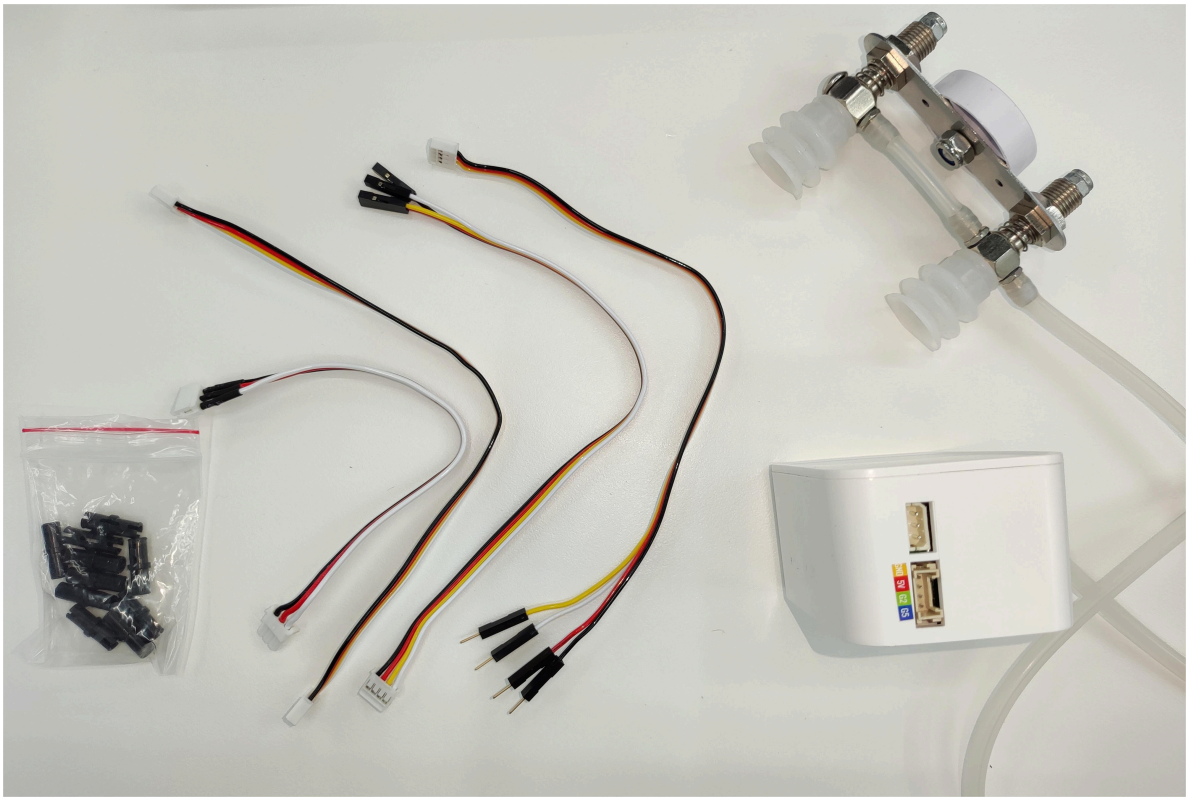
- When sucking objects: the air pump starts to suck air and adsorb objects and then stops, and there will be no leakage in a short time.
- When putting down the object: the electronic valve starts, the air release valve opens, and air enters the vacuum suction cup to separate from the sucked object.

Applicable objects

- Paper/plastic sheets
- Flat and smooth objects
- Cards, etc.

Installation and use

- Check whether the accessories package is complete: Lego connectors, Dupont wires, double-head suction pump



- Double-head suction pump installation:

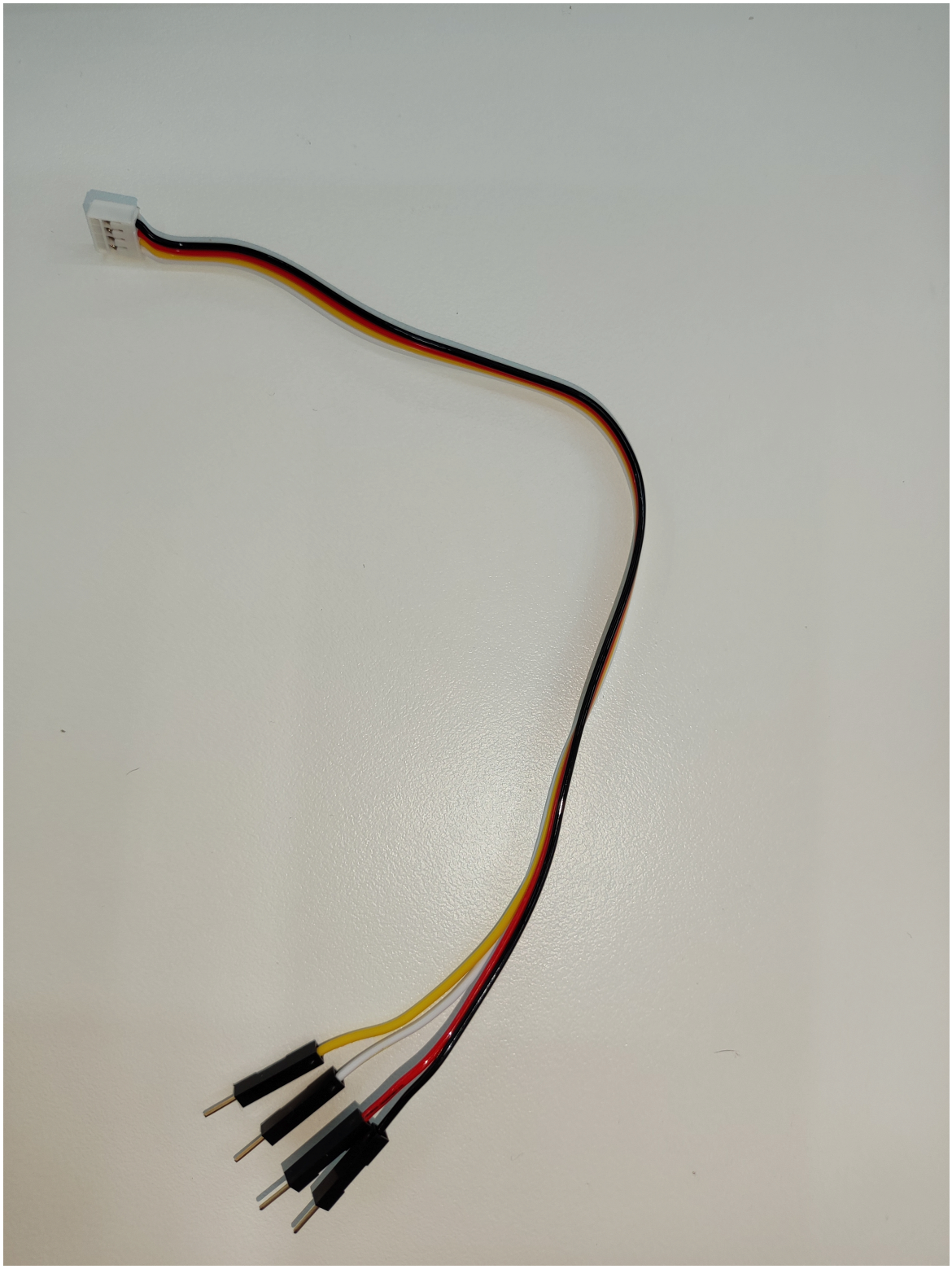
Structural installation:

Insert the Lego connector into the reserved socket on the suction pump:

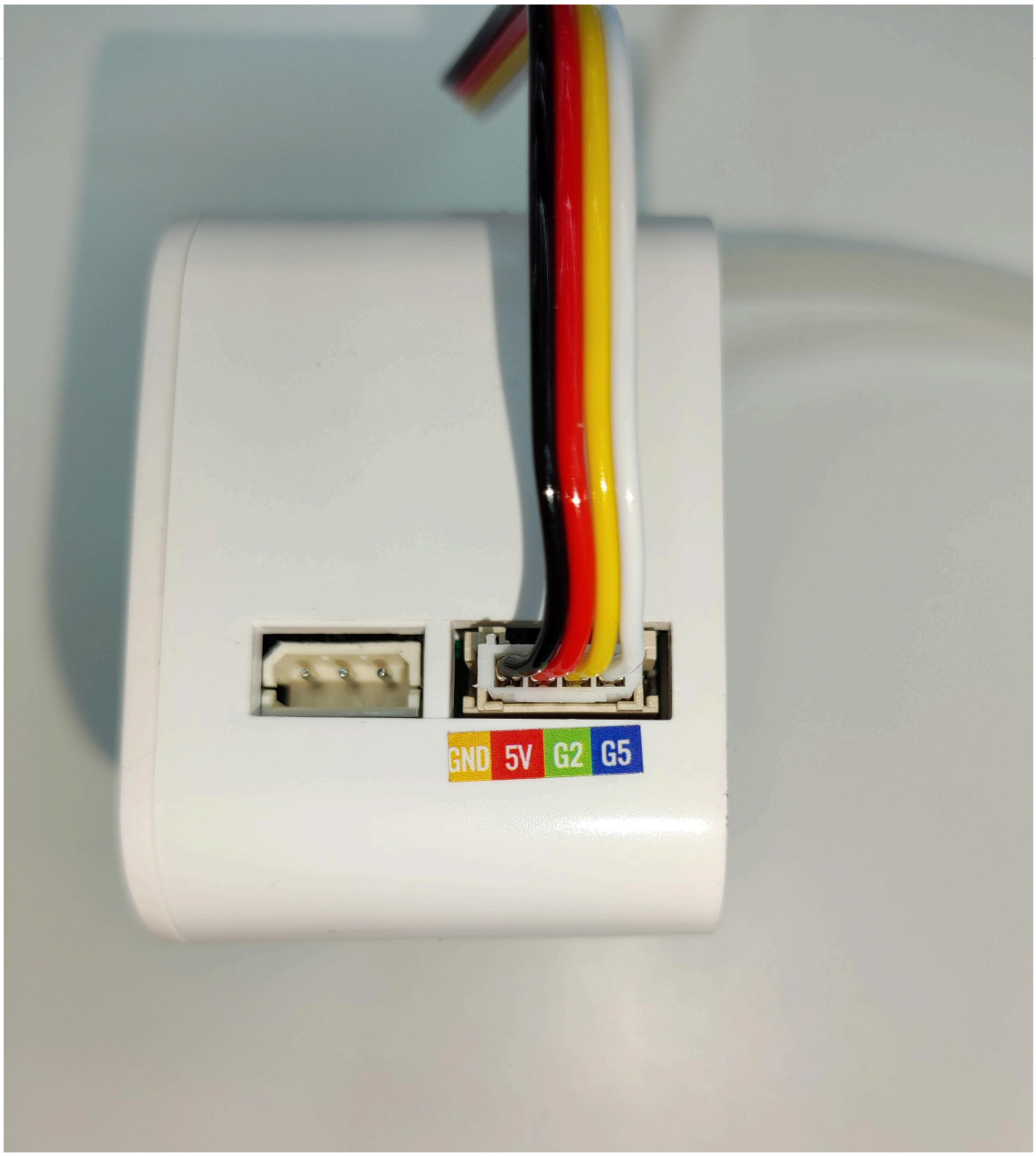
Align the suction pump with the connector plugged in with the socket at the end of the robotic arm and insert it:

- Electrical connection:

Select the male-female DuPont wire, and insert the female end into the socket marked with pins on the suction pump box:



Note the correspondence between the DuPont wire colors and pins in the figure:



Insert the male end into the robot base pin according to the given correspondence:

The left side is the suction pump pin, and the right side is the robot arm pin GND -> GND 5V -> 5V G2 -> 21 G5 -> 20

Programming development:

The code is as follows:

- 280-M5 version:

```
from pymycobot import MyCobot280
import time

# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)

# Turn on the suction pump
def pump_on():
# Open the solenoid valve
mc.set_basic_output(5, 0)
time.sleep(0.05)

# Stop the suction pump
def pump_off():
# Close the solenoid valve
mc.set_basic_output(5, 1)
time.sleep(0.05)
# The exhaust valve starts working
mc.set_basic_output(2, 0)
time.sleep(1)
mc.set_basic_output(2, 1)
time.sleep(0.05)

pump_off()
time.sleep(3)
pump_on()
time.sleep(3)
pump_off()
time.sleep(3)

GPIO.cleanup() # Release pin channel
```

- 280-Pi version:

```
from pymycobot import MyCobot280
from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two varia
import time
import RPi.GPIO as GPIO

# Initialize a MyCobot280 object
mc = MyCobot280(PI_PORT, PI_BAUD)

# Initialization
GPIO.setmode(GPIO.BCM)
# Pins 20/21 control the solenoid valve and the exhaust valve respectively
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)

# Turn on the suction pump
def pump_on():
# Open the solenoid valve
GPIO.output(20,0)

# Stop the suction pump
def pump_off():
# Close the solenoid valve
GPIO.output(20,1)
time.sleep(0.05)
# Open the vent valve
GPIO.output(21,0)
time.sleep(1)
GPIO.output(21,1)
time.sleep(0.05)

pump_off()
time.sleep(3)
pump_on()
time.sleep(3)
pump_off()
time.sleep(3)

GPIO.cleanup() # Release the pin channel
```

Save the file and close it, return to the command line terminal, and enter:

```
python pump_double.py
```

> You can see that the suction pump opens after 3 seconds and closes after working for 3 seconds

Integrated suction pump

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Specifications

Name	myCobot integrated suction pump
Model	myCobot integrated suction pump
Material	ABS injection molding
Color	White
Size	Diameter 20mm
Number of suction cups	1
Suction weight	50g
Power source equipment	Suction pump box
Service life	One year
Fixing method	Lego connector
Control interface	IO control
Use environment requirements	Normal temperature and pressure
Applicable equipment	ER myCobot 280 Series, ER myPalletizer 260 Series, ER mechArm 270 Series, ER myBuddy 280 Series

Suction pump: Used for adsorbing objects

Introduction

- Suction pump, that is, vacuum adsorption pump, has one suction nozzle and one exhaust nozzle. It has the advantages of simple structure, small size, easy use, low noise, and good self-priming ability. By controlling the suction pump kit as the end effector of the robot arm, the function of adsorbing objects is performed.
- Suction pump accessories: power cord x1, DuPont line x10, one-input and two-output connection line x1, Lego technology parts x several

Working principle

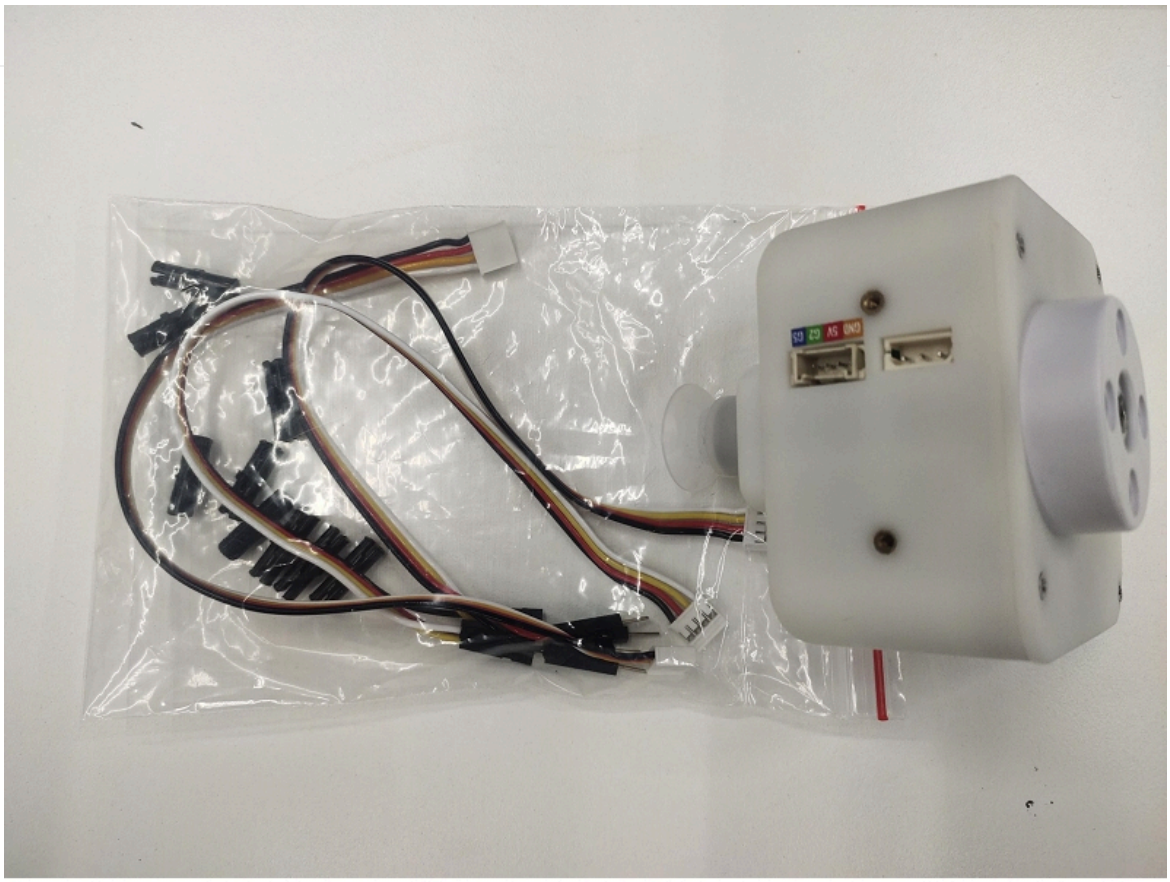
- When sucking objects: the air pump starts to suck air and adsorb objects and then stops, and there will be no air leakage in a short time.
- When putting down objects: the electronic valve starts, the air release valve opens, and air enters the vacuum suction cup to separate from the sucked objects.

Applicable objects

- Paper/plastic sheets
- Flat and smooth objects
- Cards, etc.

Installation and use

Check whether the accessories package is complete: Lego connectors, Dupont wires, double-head suction pump



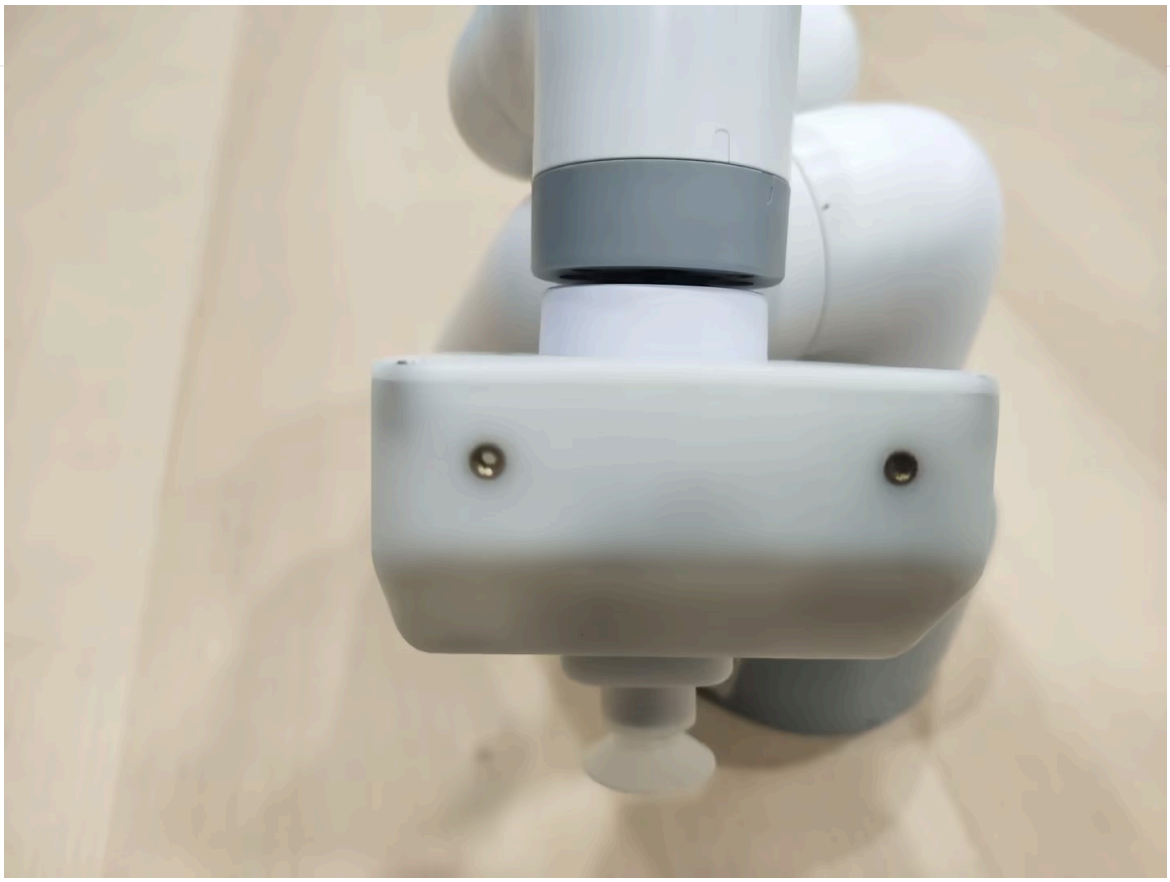
Suction pump installation

Structural installation:

Insert the Lego connector into the reserved socket on the suction pump:

1. Align the suction pump with the connector plugged in with the socket at the end of the robot arm and insert it:

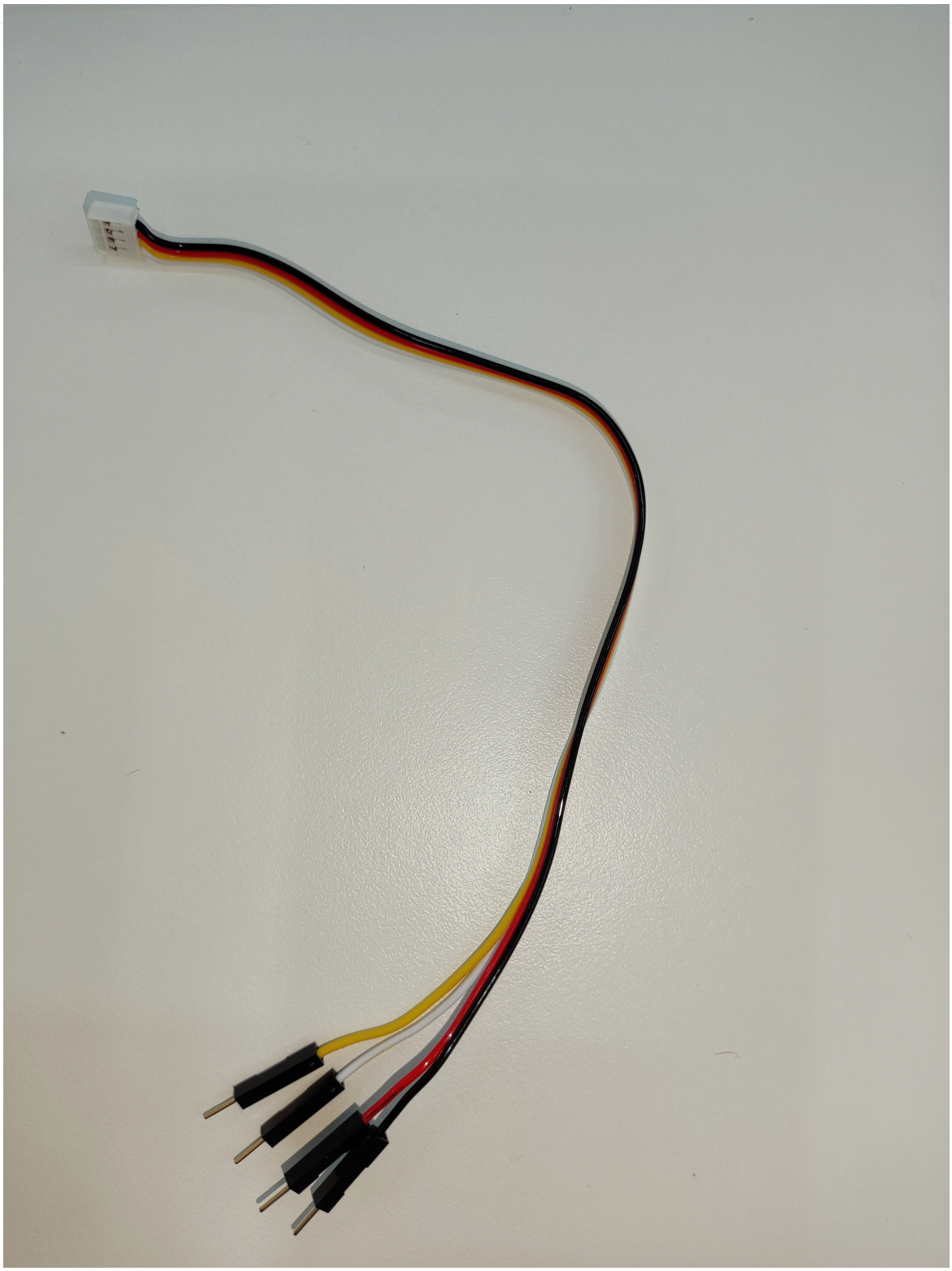
>



- Electrical connection:

Select the male-female DuPont wire, and insert the female end into the socket marked with pins on the suction pump box:

Male-female DuPont wire:



Note the correspondence between the DuPont wire colors and pins in the figure:

Insert the male end into the robot base pin according to the given correspondence:

The left side is the suction pump pin, and the right side is the robot arm pin GND -> GND 5V -> 5V G2 -> 21 G5 -> 20

Programming development:

280-M5 Version:

```
from pymycobot import MyCobot280
import time

# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)

# Turn on the suction pump
def pump_on():
# Open the solenoid valve
mc.set_basic_output(5, 0)
time.sleep(0.05)

# Stop the suction pump
def pump_off():
# Close the solenoid valve
mc.set_basic_output(5, 1)
time.sleep(0.05)
# The exhaust valve starts working
mc.set_basic_output(2, 0)
time.sleep(1)
mc.set_basic_output(2, 1)
time.sleep(0.05)

pump_off()
time.sleep(3)
pump_on()
time.sleep(3)
pump_off()
time.sleep(3)

GPIO.cleanup() # Release pin channel
```

- 280-Pi version:

```
from pymycobot import MyCobot280
from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two varia
import time
import RPi.GPIO as GPIO

# Initialize a MyCobot280 object
mc = MyCobot280(PI_PORT, PI_BAUD)

# Initialization
GPIO.setmode(GPIO.BCM)
# Pins 20/21 control the solenoid valve and the bleed valve respectively
GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)

# Turn on the suction pump
def pump_on():
# Open the solenoid valve
GPIO.output(20,0)

# Stop the suction pump
def pump_off():
# Close the solenoid valve
GPIO.output(20,1)
time.sleep(0.05)
# Open the exhaust valve
GPIO.output(21,0)
time.sleep(1)
GPIO.output(21,1)
time.sleep(0.05)

pump_off()
time.sleep(3)
pump_on()
time.sleep(3)
pump_off()
time.sleep(3)
GPIO.cleanup() # Release the pin channel
```

myCobot Pen Holder

Applicable models: ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Product image

Specifications:

Name	myCobotPro Pen Holder
Model	myCobot_penHolder_J6
Material	Photosensitive resin (painted white)
Dimensions	47.5 x 25.0 x 45.5 mm
Weight	Approx. 35g (excluding pen weight)
Pen tip clearance	±1 mm
Service life	One year
Fixing method	Lego connector
Environment requirements	Normal temperature and pressure
Applicable equipment	Support ER myCobot 280 series ER myPalletizer 260 series ER mechArm 270 series ER myBuddy 280 series

myCobot pen holder: Used when writing and drawing with a robotic arm

Introduction

- Overall solid color design, supports 15mm large stroke extension and retraction, effectively reduces errors, and can be used for writing, drawing and other applications.

Applicable objects

- Whiteboard pen

Installation and use

- Installation

Insert the Lego connector into the holder hole:

Insert the holder with the connector installed into the end of the robot arm

- Use Insert the pen into the round hole and tighten the four screws to fix it.

myCobot Phone Holder

Applicable models: ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series

Product image

Specifications:

Name	myCobot Phone Holder
Model	myCobot_PhoneHolder_J6
Material	ABS injection molding
Size	Diameter 34*10
Color	White+Black
Clamping weight	50g
Service life	Two years
Fixing method	LEGO connector
Environmental requirements	Normal temperature and pressure
Applicable equipment	ER myCobot 280 series ER mechArm 270 series ER myPalletizer 260 series

myCobot mobile phone holder: Used to hold mobile phones or objects

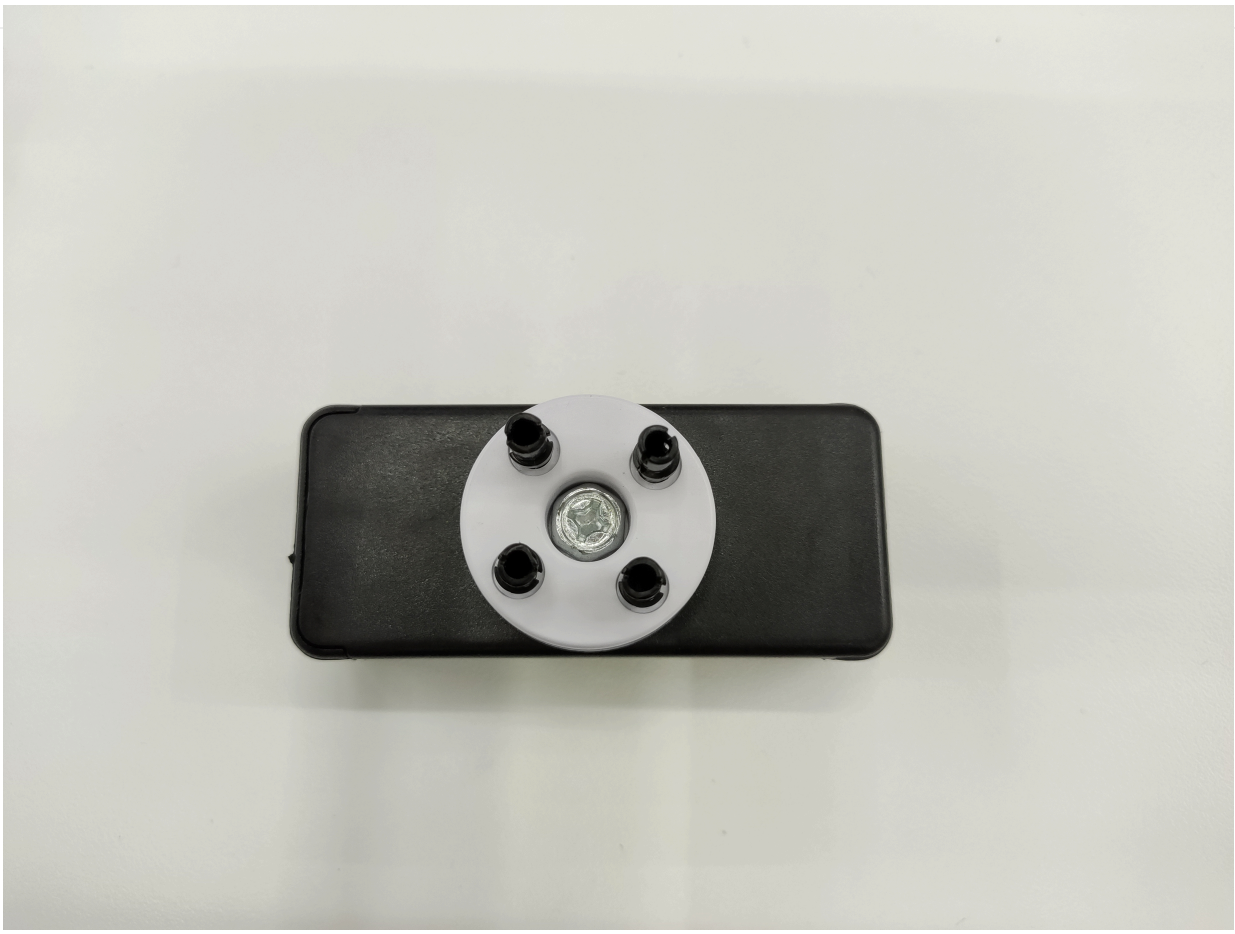
Introduction

- Suitable for devices that require physical clamping, such as photography, and can hold a variety of mobile phones. It has a simple structure and is easy to install and disassemble.

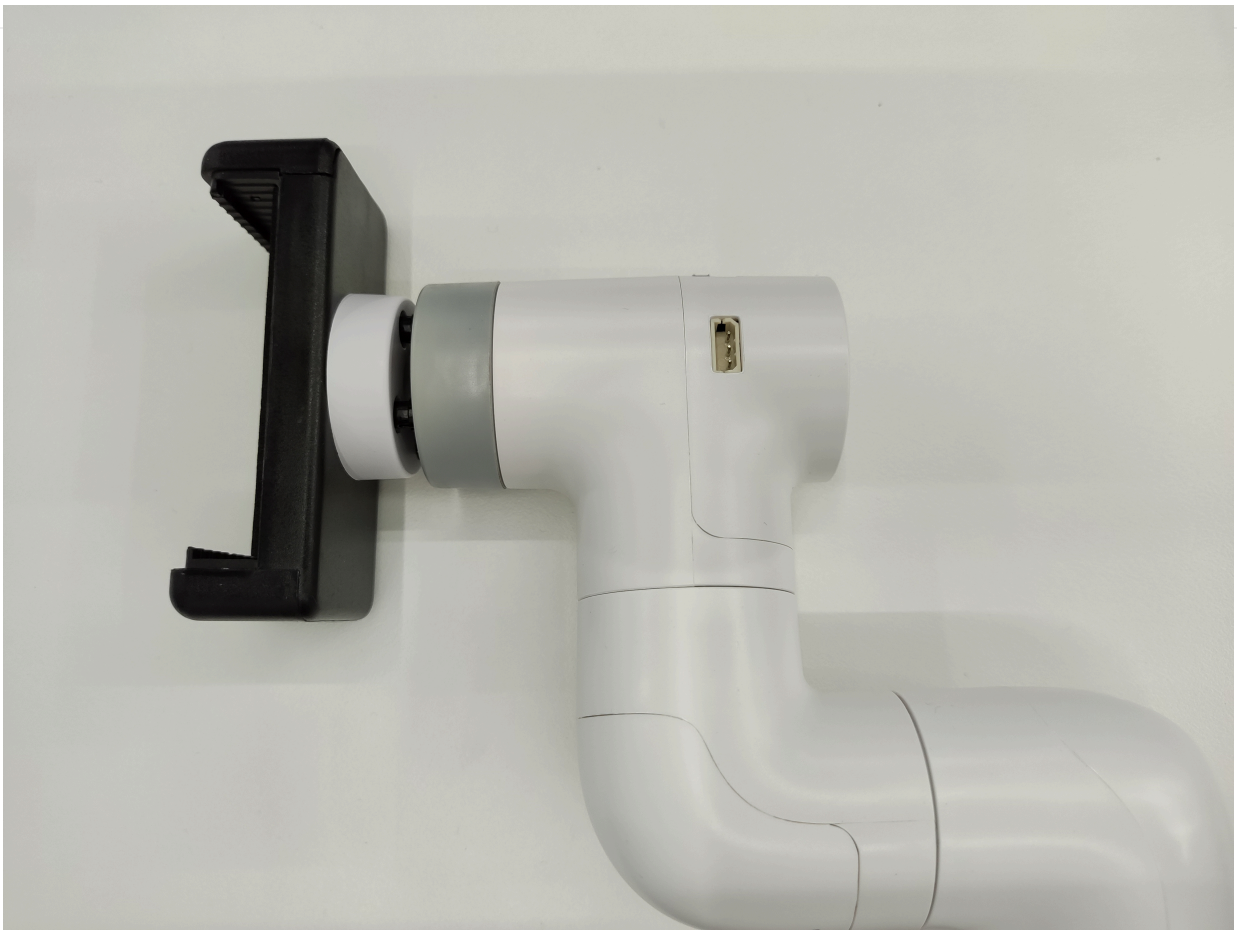
Applicable objects

- Camera equipment
- Installation

Insert the LEGO connector into the holder hole:



Insert the holder with the connector installed into the end of the robot arm



- Use Pull the holder open, put the camera in, and let go. After confirming that the device is fixed, it can be used.

Dexterous Hand

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Product Image

Specifications:

Name	mycobot Dexterous Claw
Model	Dexterous Hand
Material	3D Printing
Size	112×94×50mm
Color	White
Transmission Mode	Gear + Connecting Rod
Clamping Range	20-45mm
Maximum Clamping Force	100g
Fixing Mode	Screw Fixing
Environment Requirements	Normal Temperature and Pressure
Control Interface	Serial Control
Applicable Equipment	ER myCobot 280 Series, ER mechArm 270 Series, ER myPalletizer 260 Series

Dexterous Hand: Used when gripping objects

Introduction

- The gripper is a robot component that can achieve functions similar to human hands. It has the advantages of a complex structure, firm gripping of objects, not easy to drop, and easy operation. The gripper kit includes gripper accessories and LEGO technology parts. The end effector of the robot arm is controlled by a programmable system to achieve functions such as object gripping and multi-point positioning.

Working principle

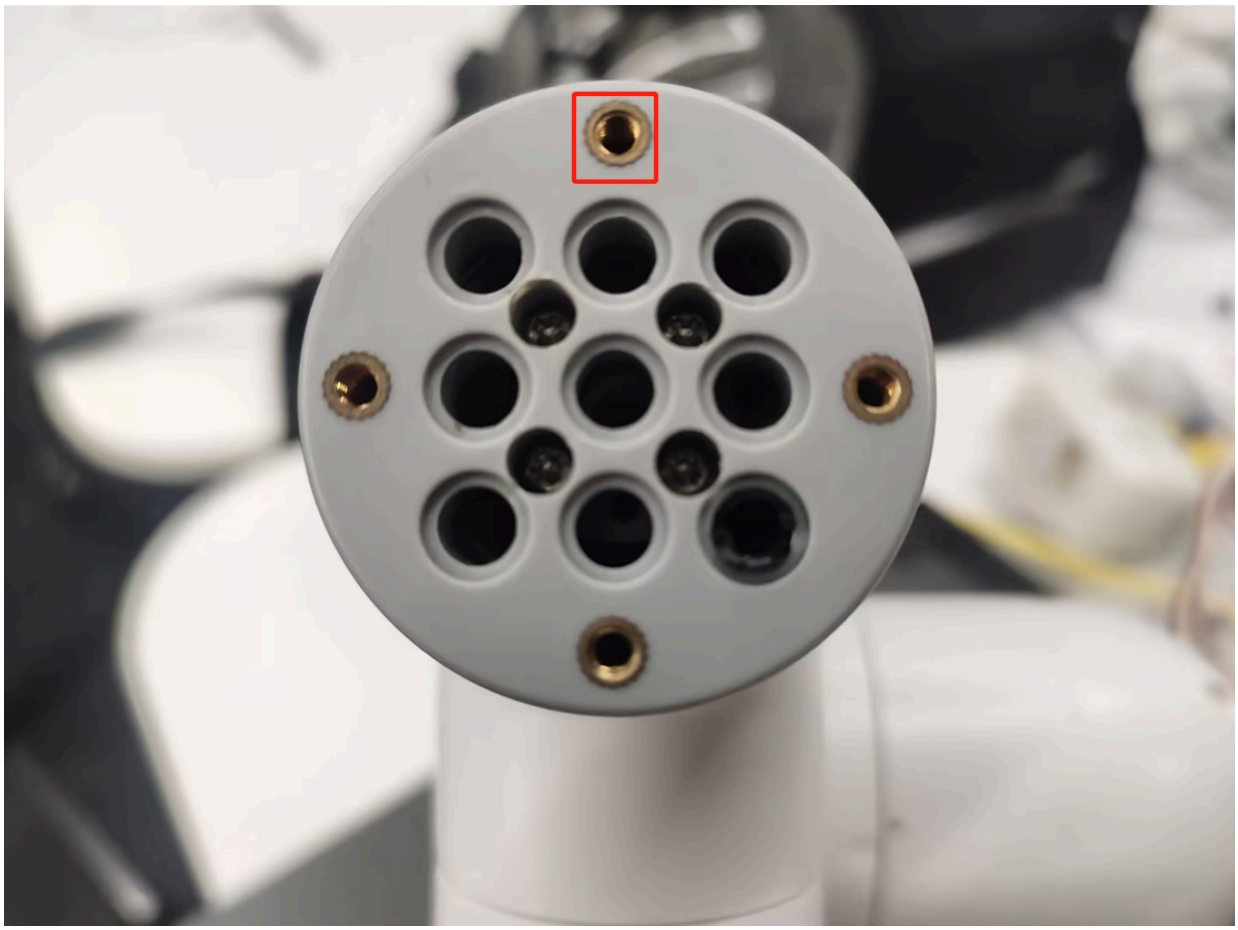
- Driven by a motor, the gripper's finger surface makes linear reciprocating motion to achieve opening or closing. The acceleration and deceleration of the electric gripper can be controlled, the impact on the workpiece can be minimized, the positioning point can be controlled, and the clamping can be controlled

Applicable objects

- Small cubes
- Small balls
- Long objects

Gripper installation:

Insert the Lego connector into the gripper hole:



Electrical connection Insert the gripper with the connector installed into the end of the robot arm

Python programming control

- M5 Version

```
from pymycobot import MyCobot280
import time


# Initialize a MyCobot280 object
mc = MyCobot280("COM3", 115200)


mc.set_encoder(7,2048,40)#Open
time.sleep(2)
mc.set_encoder(7,2300,40)#Hold
time.sleep(2)
mc.set_encoder(7,2048,40)#Hold
```

- Pi version ```python from pymycobot import MyCobot280 from pymycobot import PI_PORT, PI_BAUD # When using the Raspberry Pi version of mycobot, you can reference these two variables to initialize MyCobot import time

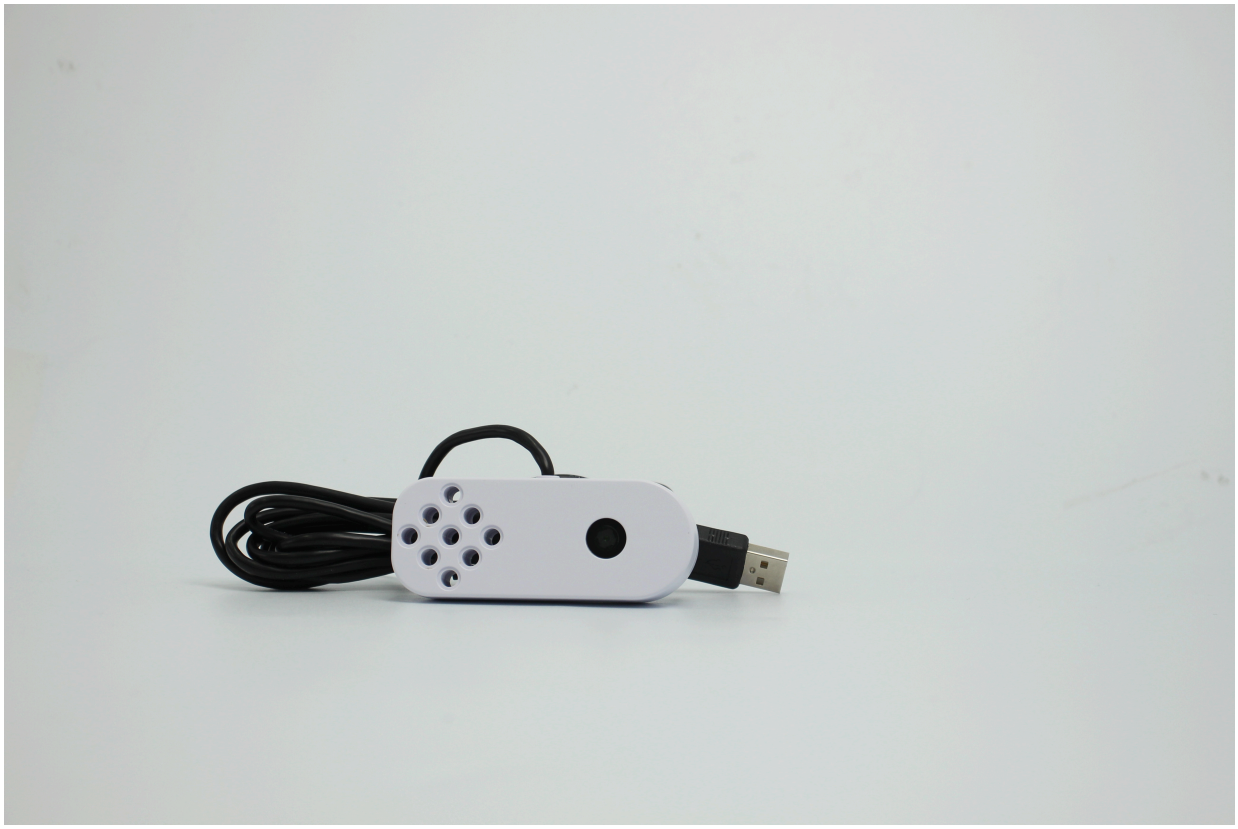
Initialize a MyCobot280 object

mc = MyCobot280(PI_PORT, PI_BAUD) mc.set_encoder(7,2048,40)#Open time.sleep(2) mc.set_encoder(7,2300,40)#Hold tight time.sleep(2) mc.set_encoder(7,2048,40)#Hold tight ```

myCobot camera module v2.0

Applicable models: myCobot 280, myPalletizer 260, mechArm 270

Product image



Specifications:

Name	myCobot camera module v2.0
Model	myCobot_cameraHolder_J6
Color	White (default)
Material	ABS injection molding
Size	836416
USB protocol	USB2.0 HS/FS
Lens focal length	Standard 1.7mm
Field of view	About 60°
Supported systems	Win7/8/10, Linux, MAC
Supported resolutions	2592x1944, 2560x1440, 2048x1536, 1920x1080, 1280x72, 1024x768, 800x600, 640x480, 640x360, 352x288, 320x240, 176x144
Service life	Two years
Fixing method	Lego connector
Environment requirements	Normal temperature and pressure
Applicable equipment support	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series, ER myBuddy 280 series

Camera flange: Machine vision

Introduction

- USB high-definition camera can be used with suction pump, adaptive gripper, artificial intelligence kit, etc., to achieve precise positioning and calibration with eye in hand.

Installation and Use

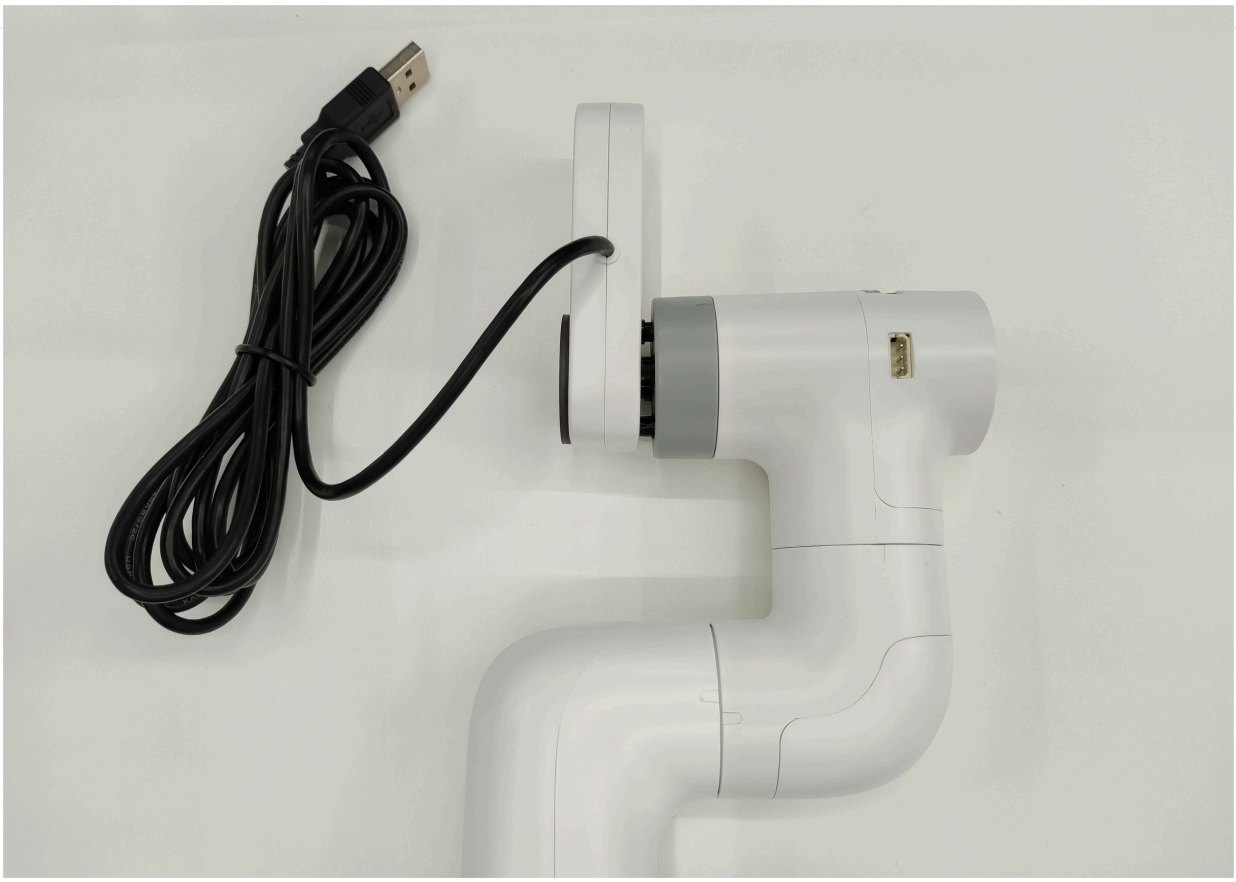
- Check if the accessories package is complete: Lego connector, camera module with USB cable

- Camera installation:

Structural installation:

Insert the Lego connector into the reserved socket of the camera module:

Align the camera module with the connector into the socket at the end of the robot arm:



Electrical connection:

Insert the USB cable into the USB port of the base:

Programming development:

> The code is as follows:

```
python
import cv2
import numpy as np

cap = cv2.VideoCapture(0) # "0", determined by the camera device number queried

while(True):
ret, frame = cap.read()

# gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

cv2.show('frame', frame)
if cv2.waitKey(1) & 0xFF == ord('q'):
break

cap.release()
cv2.destroyAllWindows()
```

Spring Bamboo Shoot Flange

Applicable models: ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series

Product image

Specifications:

Name	myCobot Spring Bamboo Shoot Flange
Material	Nylon
Hardness	Fragile
Service life	Two years
Fixing method	Lego connector
Environmental requirements	Normal temperature and pressure
Applicable equipment	ER myCobot 280 series, ER myPalletizer 260 series, ER mechArm 270 series

myCobot Spring Bamboo Shoot Flange: Used for clicking buttons

Introduction

- Suitable for devices with physical travel such as click buttons and keyboards. The overall solid color design, simple structure, easy to install and disassemble.

Applicable objects

- Keyboard
- Button

Acknowledgements

We would like to express our deep gratitude to all the people who have participated in the development, testing and improvement of the myCobot series of products (including myCobot 280 pi, myCobot 280 M5, myCobot 280 JN, myCobot 280 For Arduino and kits). Every detail polished and every feature innovative is inseparable from the hard work and dedication of the team behind it.

Special thanks:

R&D Team: Thank you for your innovative thinking and countless days and nights of hard work to transform complex technology into user-friendly products. **QA & Testing Team**: Your strict control of every detail ensures the reliability of our products and the ultimate experience of users. **Customer Support Team**: Thank you for providing professional support to our users to help them solve every problem during use. **Partners & Suppliers**: Your support and service are crucial to the success of the product. Thank you for your high-quality raw materials and components, and your attitude of being ready to support. **Investors and Advisors**: Without your trust and financial support, we would not be able to bring these innovations to the market. Your insights and guidance have always been our driving force.

User Thanks:

We are especially grateful to every user who has chosen and trusted the myCobot series of products. Your feedback and suggestions are the driving force for our continuous progress and improvement. We promise to continue to listen to your voice and continuously optimize our products and services.

Future Outlook:

We look forward to continuing to explore and progress on the road of robotics with all stakeholders. Let us work together to create more possibilities and bring greater convenience and innovation to the world.

← Previous Chapter