Control the joint angle of the robot arm

1. API Introduction

power_off()

Function explanation: Unload the robot arm. After unloading, the robot arm no longer maintains the posture and can be moved by hand.

Parameter explanation:

- Return value: None

power_on()

Function explanation: Enable the robot arm. After enabling, the robot arm cannot be moved by hand.

Parameter explanation:

- Return value: None

2. Important code explanation

Code path: ~/jetcobot_ws/src/jetcobot_ctrl/scripts/ctrl_joints.ipynb

Create three buttons to control the robot arm reset, enable, and uninstall functions.

```
def on_button_clicked(b):
    with output:
        print("Button clicked:", b.description)
    if b.description == 'Reset':
        reset_joints()
    elif b.description == 'Power_on':
        mc.power_on()
        b.icon = 'check'
        button_power_off.icon = 'uncheck'
    elif b.description == 'Power_off':
        mc.power_off()
        b.icon = 'check'
        button_power_on.icon = 'uncheck'
```

Create seven new sliders to control the six joints and grippers of the robot arm.

```
def on_slider_S1(angle):
    print("J1:", angle)
    mc.send_angle(1, angle, g_speed)
def on_slider_S2(angle):
    print("J2:", angle)
    mc.send_angle(2, angle, g_speed)
def on_slider_S3(angle):
    print("J3:", angle)
    mc.send_angle(3, angle, g_speed)
def on_slider_S4(angle):
    print("J4:", angle)
    mc.send_angle(4, angle, g_speed)
def on_slider_S5(angle):
    print("J5:", angle)
    mc.send_angle(5, angle, g_speed)
def on_slider_S6(angle):
    print("J6:", angle)
    mc.send_angle(6, angle, g_speed)
def on_slider_S7(angle):
    print("G7:", angle)
    mc.set_gripper_value(angle, g_speed)
```

Create a new slider to control the movement speed of the servo.

```
slider_speed = widgets.IntSlider(description='Speed:', value=50, min=1, max=100,
step=1, orientation='horizontal')

def on_slider_speed(value):
    global mc, g_speed
    g_speed = value
    print("speed:", value)

widget_speed = widgets.interactive(on_slider_speed, value=slider_speed)
```

Reset the joint angles of the robot arm.

```
def reset_joints():
    if button_power_off.icon == 'check':
        mc.power_on()
        time.sleep(1)
    mc.send_angles([0, 0, 0, 0, 0, -45], 50)
    mc.set_gripper_value(100, 50)
    slider_S1.value = 0
    slider_S2.value = 0
    slider_S3.value = 0
    slider_S4.value = 0
    slider_S5.value = 0
    slider_S6.value = -45
    slider_S7.value = 100
    slider_speed.value = 50
    button_power_on.icon = 'check'
    button_power_off.icon = 'uncheck'
```

Create a camera display window to read the camera image in real time and display it.

```
imgbox = widgets.Image(format='jpg', width=640, height=480,
layout=widgets.Layout(align_self='center'))
model = 'Start'
```

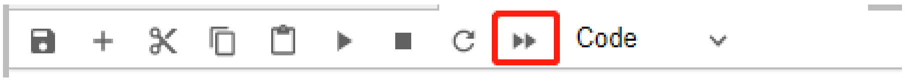
```
def camera():
    global model
    capture = cv.VideoCapture(0)
    capture.set(cv.CAP_PROP_FRAME_WIDTH, 640)
    capture.set(cv.CAP_PROP_FRAME_HEIGHT, 480)
    while capture.isOpened():
        try:
            _, img = capture.read()
            if model == 'Exit':
                break
            imgbox.value = cv.imencode('.jpg', img)[1].tobytes()
        except:
            break
    with output:
        print("capture release")
    capture.release()
```

Create a close button to end the program and release resources.

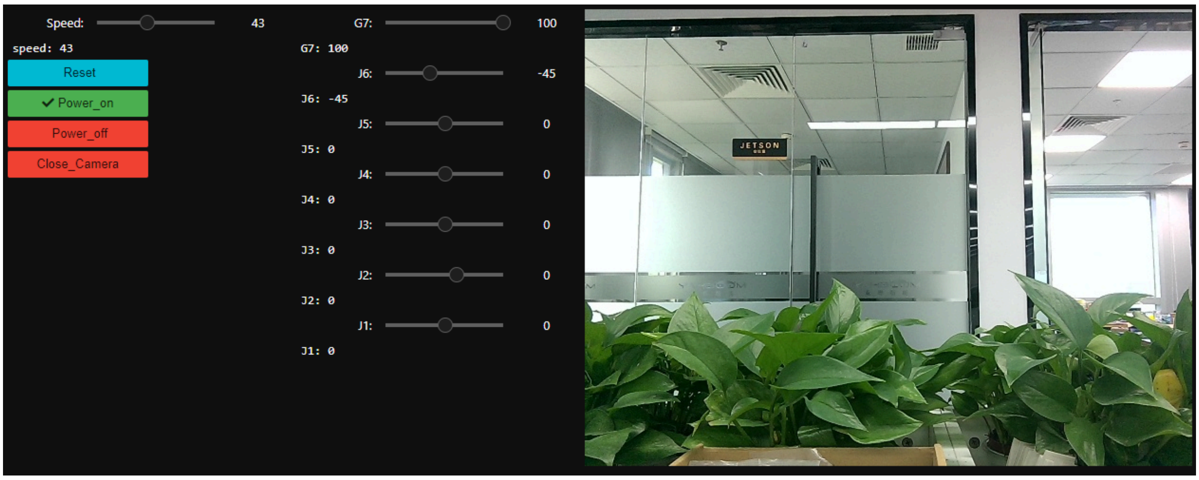
```
button_close = widgets.Button(description='Close_Camera', button_style='danger')
def button_close_Callback(value):
    global model
    model = 'Exit'
    with output: print(model)
button_close.on_click(button_close_Callback)
```

3. Run the program

Click the Run the entire program button on the jupyterlab toolbar, and then pull it to the bottom.

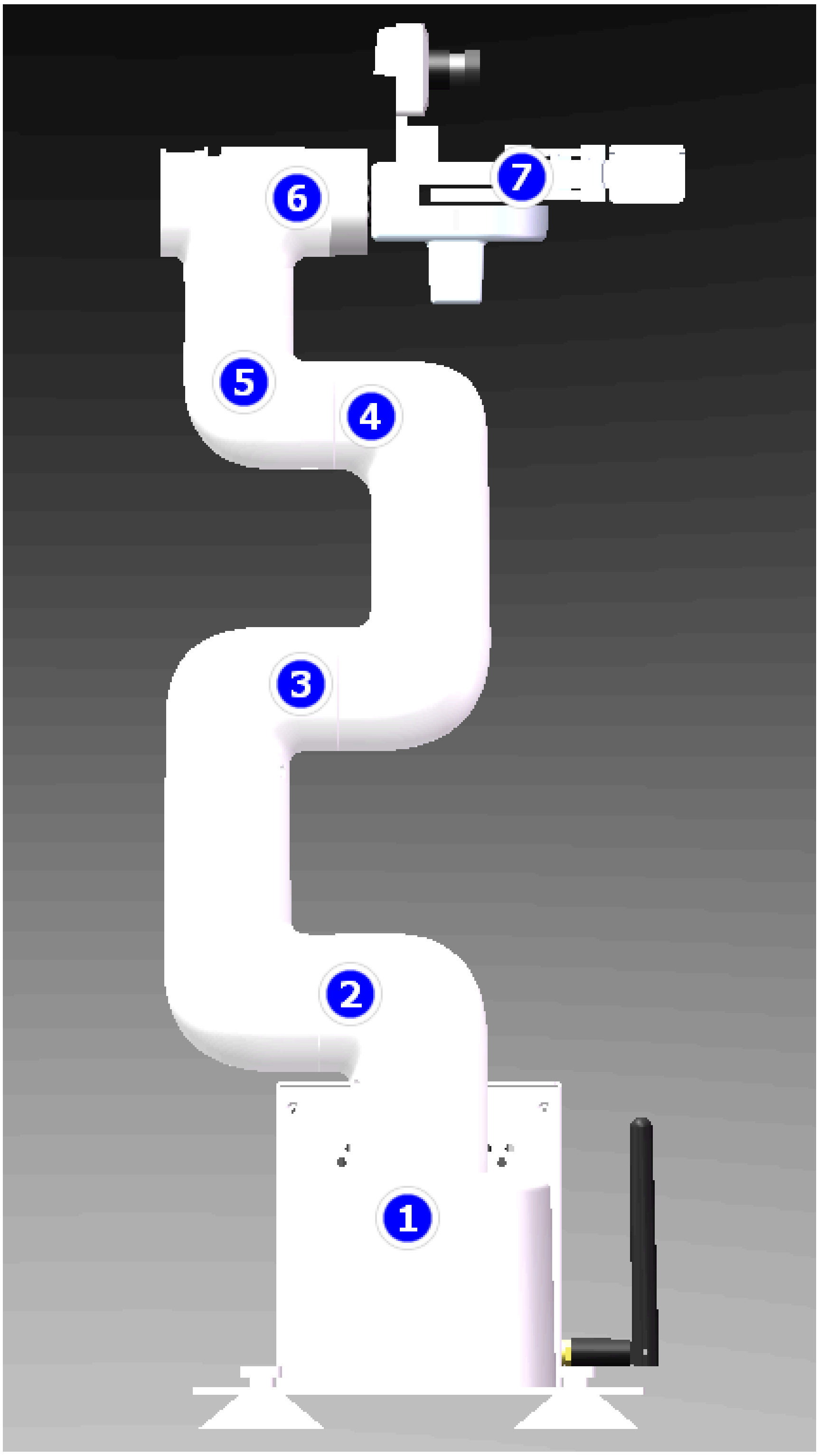


You can see that the relevant control controls are displayed on the left, and the camera display screen is displayed on the right.



```
Speed: 43
speed: 43
G7: 100
G7: 100
J6: -45
J6: -45
J5: 0
J5: 0
J4: 0
J4: 0
J3: 0
J3: 0
J2: 0
J2: 0
J1: 0
J1: 0
```

The corresponding positions of the robot arm joints are shown in the figure below.


7
6
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