Drive stepper motor

1. Learning target

1.1 In this course, we will learn how to use pins of the Raspberry Pi Pico board.

1.2 How to drive the stepper motor.

2. Preparation

Raspberry Pi Pico board *1

Sensor expansion board *1

PC *1

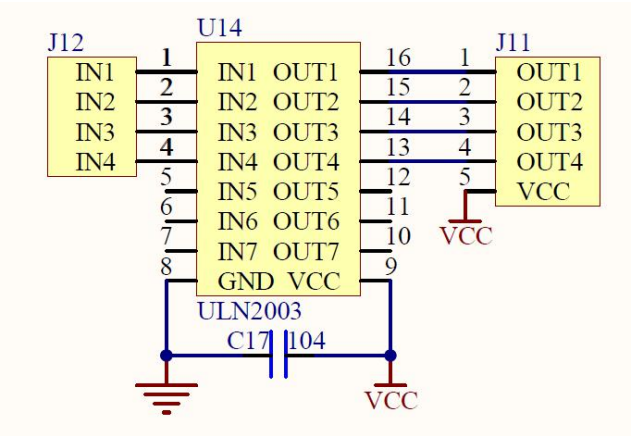
USB data cable *1

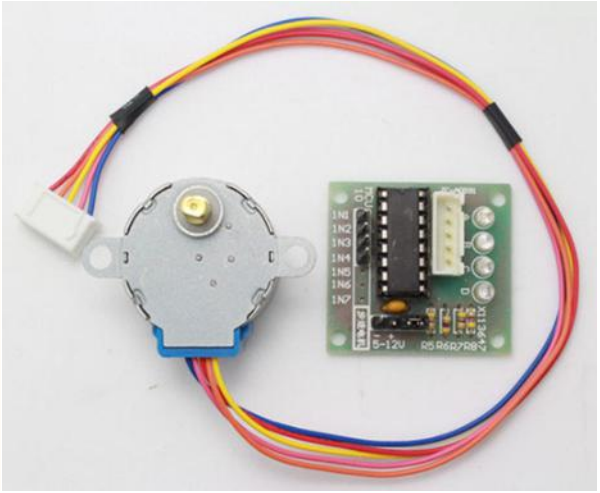
Stepper motor*1

ULN2003 drive module *1

Male-to-male DuPont line *6

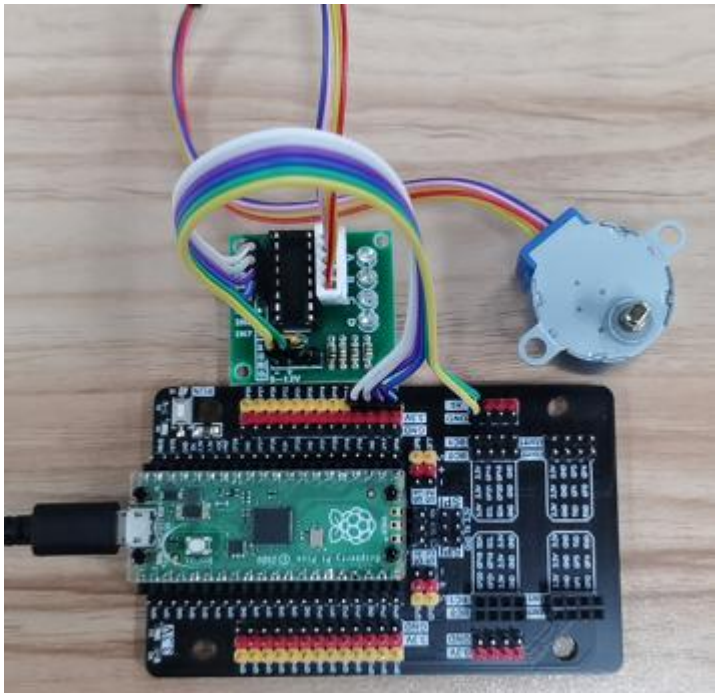
ULN2003 drive board SCH, as shown below.





3. About wiring

ULN2003 board	Pico sensor expansion board
IN1	GP16
IN2	GP15
IN3	GP14
IN4	GP13
Negative electrode(-)	GND
Positive electrode(-)	5V



4. About code

Thonny programming

About how to using ThonnyIDE, please check the tutorials in【2.Development environment】

```
from machine import Pin
import utime

# Pin initialization
in1 = Pin(16, Pin.OUT)
in2 = Pin(15, Pin.OUT)
in3 = Pin(14, Pin.OUT)
in4 = Pin(13, Pin.OUT)

# Delay time
delay = 1

# The number of steps required for the motor to rotate one revolution, (about 360°), with a slight deviation
ROUND_VALUE = 509

# The sequence value of the four-phase eight-beat stepper motor: A-AB-B-BC-C-CD-D-DA-A。
STEP_VALUE = [
    [1, 0, 0, 0],
    [1, 1, 0, 0],
    [0, 1, 0, 0],
    [0, 1, 1, 0],
    [0, 0, 1, 0],
```

```
    [0, 0, 1, 1],
    [0, 0, 0, 1],
    [1, 0, 0, 1],
]

# Pin output low level
def reset():
    in1(0)
    in2(0)
    in3(0)
    in4(0)

# If count is positive integers turn clockwise, if count is negative integers turn counterclockwise
def step_run(count):
    direction = 1        # turn clockwise
    if count < 0:
        direction = -1    # turn counterclockwise
        count = -count
    for x in range(count):
        for bit in STEP_VALUE[::direction]:
            in1(bit[0])
            in2(bit[1])
            in3(bit[2])
            in4(bit[3])
            utime.sleep_ms(delay)
    reset()

# If a is positive integers turn clockwise, if a is negative integers turn counterclockwise
def step_angle(a):
    step_run(int(ROUND_VALUE * a / 360))

# Cycle: turn clockwise one circle, then counterclockwise one circle.
while True:
    step_run(509)
    step_run(-509)
    step_angle(360)
    step_angle(-360)
```

5. Phenomenon

Click the green run button  of Thonny IDE to start running the program. Click the red stop button  to stop the program. When the program is running, the ABCD four red lights of the

ULN2003 drive module are on, and the stepper motor first rotates clockwise, then counterclockwise, and keep the cycle in this state.