

电机实验

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2024.3.32

电机实验

- 实验要求
- 实验内容
- 实验步骤
 - 电路连线
 - 使用OutputDevice类驱动直流电动机
 - 使用OutputDevice类驱动步进电动机
 - 正转
 - 反转
 - 停止
 - 步进式电机特定角度旋转

实验要求

- 理解驱动直流电机方法的基础上，使用OutputDevice类来驱动直流电机
- 驱动步进电机，能够实现正转、反转及停止，要求：分别转动45°、90°、180°、360°时停止，并能够直观显示该旋转角度
- 报告中思考并回答：该步进电机旋转一周需要多少步，步进角是多少

实验内容

- 使用器材
 - DRV8833 (TI)
 - 树莓派 Pi4
- 使用python库

| Package | Version |
|----------|---------|
| gpiozero | 1.6.2 |
| lgpio | 0.0.0.2 |
| pip | 23.0.1 |
| RPi.GPIO | 0.7.1 |

- 直流电机的使用示例
- 将电机开关拨至DC Moter档

```

1 from gpiozero import OutputDevice
2 from time import sleep
3 from signal import pause
4
5 A1 = OutputDevice(27)
6 A2 = OutputDevice(17)
7 ..
8 pause()

```

- 步进电机的使用示例

将电机开关拨至Step Motor档

```

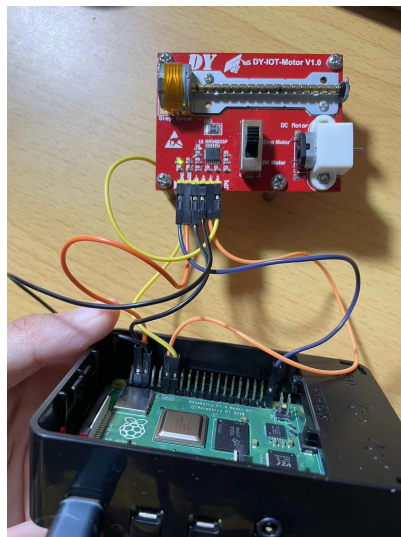
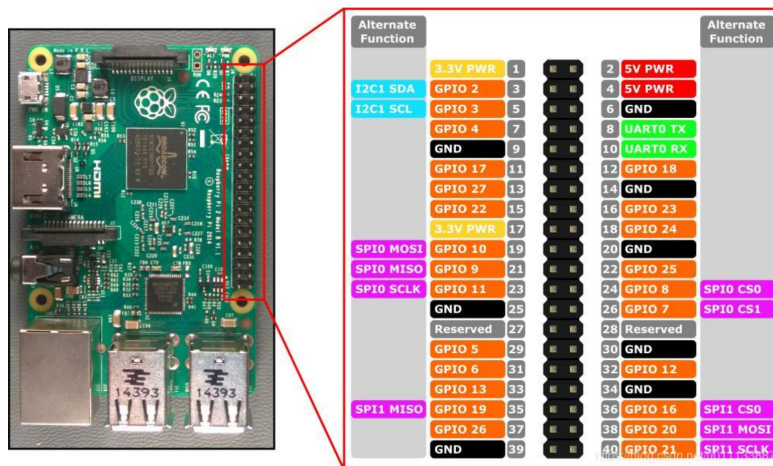
1 import time
2 import sys
3 from gpiozero import OutputDevice as stepper
4 def moveForward(stepCounter):
5     ....
6 A+=stepper(27)
7 A-=stepper(17)
8 B+=stepper(3)
9 B-=stepper(2)
10 stepPins=[A+,A-,B+,B-]# Motor GPIO pins
11 stepDir=1           #Set to 1 for clockwise
12 .....             #Set to -1 for anti-clockwise
13 seg=[[1,0,0,0],Define step sequence
14     [0,1,0,0],
15     [0,0,1,0],
16     [0,0,0,1]]
17 stepcount=len(seg)

```

实验步骤

电路连线

| 树莓派 | 电机模块 |
|--------|------|
| 5V | VDD |
| GND | GND |
| GPIO27 | A+ |
| GPIO17 | A- |
| GPIO3 | B+ |
| GPIO2 | B- |



使用OutputDevice类驱动直流电动机

实现的效果为：

DC Motor转动两秒后停止

```

1  from gpiozero import OutputDevice
2  from time import sleep
3  from signal import pause
4
5  A1 = OutputDevice(27)
6  A2 = OutputDevice(17)
7  stepPins = [A1,A2]
8  stepPins[0].on() # 0或1都可
9  sleep(2)
10 stepPins[0].off()
11 pause()

```

使用OutputDevice类驱动步进电动机

正转

实现效果为：步进式电机正转

关键代码如下所示，视频见forward.mp4。

```

1  A1 = OutputDevice(27)

```

```

2  A2 = OutputDevice(17)
3  B1 = OutputDevice(3)
4  B2 = OutputDevice(2)
5  seq = [[1,0,0,0],[0,1,0,0],[0,0,1,0],[0,0,0,1]]
6  stepPins = [B2,A2,B1,A1]
7  stepCount = len(seq)
8  while True:
9      for i in range(0,stepCount):
10         for j in range(0,stepCount):
11             if seq[i][j] == 1:
12                 stepPins[i].on()
13                 sleep(0.2)
14                 stepPins[i].off()

```

反转

实现效果为：步进式电机反转

将步进序列反转即可实现反转。关键代码如下所示，视频见reverse.mp4。

```

1  A1 = OutputDevice(27)
2  A2 = OutputDevice(17)
3  B1 = OutputDevice(3)
4  B2 = OutputDevice(2)
5  seq = [[0,0,0,1],[0,0,1,0],[0,1,0,0],[1,0,0,0]]
6  stepPins = [B2,A2,B1,A1]
7  stepCount = len(seq)
8  while True:
9      for i in range(0,stepCount):
10         for j in range(0,stepCount):
11             if seq[i][j] == 1:
12                 stepPins[i].on()
13                 sleep(0.2)
14                 stepPins[i].off()

```

停止

使用pause()即可停止

步进式电机特定角度旋转

- 以正转为例
- 要求：分别转动45°、90°、180°、360°时停止

1. 测量旋转一周需要多少步

在步进电机的转轴上使用黑色记号笔做好标记。使其慢速正转一周，测量3次可知旋转一周需要20步。其**步进角**为 $360^\circ/20 = 18^\circ$

2. 实现思路

使用flag变量计算当前的步数。已知旋转周期为20步。

- 45°

在 $45/18 = 2.5$ 步时为45°，因此在 `(flag % 20) == 2` 时输出

```
print('Because the angle is about 45, so stop.')
```

- $90^\circ/180^\circ/360^\circ$

可被18整除, 结果为: 5/10/20。因此在 $(\text{flag} \% 5) == 0$ 时输出

```
print('Because the angle is', (flag % 20) * 18, ' so stop.')
```

3. 完整代码

实现效果为: 在 45° 、 90° 、 180° 、 360° 时停止。关键代码如下所示, 视频见angle.mp4。

```
1  seq = [[1,0,0,0],[0,1,0,0],[0,0,1,0],[0,0,0,1]]
2  stepPins = [B2,A2,B1,A1]
3
4  stepCount = len(seq)
5  sleep(1)
6  flag = 0
7
8  while True:
9      for i in range(0, stepCount): # Loop in reverse for anti-clockwise
10         for j in range(0, stepCount):
11             if seq[i][j] == 1:
12                 stepPins[j].on()
13                 sleep(0.2)
14                 stepPins[j].off()
15                 flag = flag + 1
16                 print('The angle is', (flag % 20) * 18)
17                 if (flag % 5) == 0:
18                     print('Because the angle is', (flag % 20) * 18, ' so
19 stop.')
```

The angle is 18
The angle is 36
Becuase The angle is about 45, so stop.
The angle is 54
The angle is 72
The angle is 90
Becuase The angle is 90 so stop.
The angle is 108
The angle is 126
The angle is 144
The angle is 162
The angle is 180
Becuase The angle is 180 so stop.
The angle is 198
The angle is 216
The angle is 234
The angle is 252
The angle is 270
Becuase The angle is 270 so stop.
The angle is 288
The angle is 306
The angle is 324
The angle is 342
The angle is 0
Becuase The angle is 0 so stop.