

## Chapter19: QR code recognition

### About QR code:

The content of this project is mainly for extracting and printing information of QR Code (Quick Response Code).

How to generate a QR code?

You can find ways to generate QR codes online.

Two open source software for QR code recognition, zbar and pyzbar.

In this chapter, we will provide two ways to identify the QR code:

- 1) pyzbar, which derived from zbar
- 2) Processing zbar.

We need to input this command at the terminal:

```
sudo apt-get install lizbar0
```

```
sudo pip install pyzbar
```

After the download is complete, you can input `import pyzbar` in the spyder python to check if the installation is successful.

The source code of the program is located at: `/home/pi/yahboom/QRCODE/qrcode1.py`

In this program, in addition to pyzbar, we will use `imutils` and `argparse` to simplify "camera use" and "parameter reference".

The code as shown in the figure below.

```
1 #!/usr/bin/env python2
2 #-*- coding: utf-8 -*-
3 """
4 * @par Copyright (C): 2010-2019, Shenzhen Yahboom Tech
5 * @file      qr code
6 * @version    V1.0
7 * @details
8 * @par History
9 * @author: longfuSun
10 """
11
12 from imutils.video import VideoStream
13 from pyzbar import pyzbar
14 import argparse
15 import datetime
16 import imutils
17 import time
18 import cv2
19
20 ap=argparse.ArgumentParser()
21 #Provide a csv file, the QR code content can be displayed on the screen and as a
22 ap.add_argument("-o", "--output", type=str, default="content.csv",
23               help="path to output csv file containing barcode")
24 args=vars(ap.parse_args())
25
26 print('starting video stream...')
27 #Command of using web camera
28 vs=VideoStream(src=0).start()
29 #Command of using web Raspberry Pi's own camera
30 #vs=VideoStream(usePiCamera=True).start()
31 time.sleep(2.0)
32
33 #Write content to csv
34 csv=open(args["output"], "w")
35 found=set()
36 while True:
37     frame=vs.read()
38     frame=imutils.resize(frame,width=400)
39     barcodes=pyzbar.decode(frame)
```

```

40 for barcode in barcodes:
41     (x,y,w,h)=barcode.rect
42
43     cv2.rectangle(frame,(x,y),(x+w,y+h),(0,0,255),2)
44     #Decode the contents of the QR code, enter the time, content and type
45     barcodeData=barcode.data.decode("utf-8")
46     barcodeType=barcode.type
47
48     text="{},{ {}".format(barcodeData,barcodeType)
49
50     cv2.putText(frame,text,(x,y-10),cv2.FONT_HERSHEY_SIMPLEX,0.5,
51                (0,0,255),2)
52
53     if barcodeData not in found:
54         csv.write("{}{}\n".format(datetime.datetime.now(),barcodeData))
55         csv.flush()
56         found.add(barcodeData)
57     cv2.imshow("found_code",frame)
58     key=cv2.waitKey(1)&0xFF
59     if key==ord("q"):
60         break
61
62
63 csv.close()
64 cv2.destroyAllWindows()
65 vs.stop()

```

The result is as shown in the figure below.



### 3. The combination of QR code and Raspberry Pi hardware:

First, we need to prepare 5 QR codes, each corresponding to the encoding of a gpio command string.



1.red\_yello\_blue light up



2. right\_left servo turn 0



3.right\_left servo turn 180



4.turn down



5. turn up

No1 QR code : starts the RGB lights.

No2 QR code: control servo turn 0

No3 QR code: control servo turn 180

No4 QR code: control servo turn down

No5 QR code: control servo turn up

In addition, the control expansion board The buzzer on the alarm is given and the control is abandoned.

In addition, in order to ensure the safety of the hardware, we need to make certain restrictions on the rotation of the servo. When the servo is turned to the far right, the buzzer will alarm on the expansion board and the give up control.

When the camera detects the QR code, it immediately decodes the QR code and adjusts the corresponding execution function.

For example, the code for servo turn left is as follows:

```
def right():
    global servo_rightleft
    servo_rightleft-=50
    if servo_rightleft<=170 or servo_rightleft>=570: warning()
    else :    pwm.set_pwm(0, 0, servo_rightleft)
```

We use two functions to control the rotation angle of the same servo, so use the global statement in the function.

The pulse value of each rotation is 50, about 20°, when the real-time pulse value is close to the critical value, call `warning()` function will start the buzzer.

There are two codes in this experiment. The first one is to decode and respond to the QR code. The second one will try to introduce Baidu speech. Each time, a QR code is recognized and an action is completed, it will broadcast action.

The first source code of the program is located at:

[/home/pi/Adafruit\\_Python\\_PCA9685/qrcode\\_motion.py](/home/pi/Adafruit_Python_PCA9685/qrcode_motion.py)

```

1 #!/usr/bin/env python2
2 # -*- coding: utf-8 -*-
3 """
4
5 * @par Copyright (C): 2010-2019, Shenzhen Yahboom Tech
6 * @file      qrcode-motion
7 * @version    V1.0
8 * @details
9 * @par History
10
11 @author: longfuSun
12 """
13 from __future__ import division
14 from imutils.video import VideoStream
15 from pyzbar import pyzbar
16 import argparse
17 import datetime
18 import imutils
19 import time
20 import cv2
21 import RPi.GPIO as GPIO
22 import Adafruit_PCA9685
23
24 #Initialize gpio
25 GPIO.setmode(GPIO.BCM)
26 GPIO.setup(10,GPIO.OUT)
27 GPIO.setup(9,GPIO.OUT)
28 GPIO.setup(11,GPIO.OUT)
29 #Initialize servo
30 servo_updown=390
31 servo_rightleft=390
32 pwm = Adafruit_PCA9685.PCA9685()
33 pwm.set_pwm_freq(60)
34 pwm.set_pwm(0, 0, servo_rightleft)
35 pwm.set_pwm(1, 0, servo_updown)
36 #when the servo is over the allowable angle, buzzer will alarm
37 def warning():
38     GPIO.setup(16,GPIO.OUT)
39     GPIO.output(16,True)
40     time.sleep(1)
41     GPIO.output(16,False)
42
43 #water lights
44 def red_yellow_blue():
45     for i in range(0,2):
46         GPIO.output(9,True)
47         time.sleep(0.1)
48         GPIO.output(10,True)
49         time.sleep(0.1)
50         GPIO.output(11,True)
51         time.sleep(0.1)
52         GPIO.output(10,False)
53         time.sleep(0.1)
54         GPIO.output(9,False)
55         time.sleep(0.1)
56         GPIO.output(11,False)
57
58 #Two degrees of freedom steering of the servo
59 def right():
60     global servo_rightleft
61     servo_rightleft-=50
62     if servo_rightleft<=170 or servo_rightleft>=570:
63         warning()
64     else :
65         pwm.set_pwm(1, 0, servo_rightleft)
66
67 def left():
68     global servo_rightleft
69     servo_rightleft+=50
70     if servo_rightleft<=170 or servo_rightleft>=570:
71         warning()
72     else :
73         pwm.set_pwm(1, 0, servo_rightleft)
74
75 def turn_down():
76     global servo_updown
77     servo_updown-=50
78     if servo_updown<=170 or servo_updown>=570:
79         warning()
80     else:
81         pwm.set_pwm(2,0,servo_updown)

```

```

79 def turn_up():
80     global servo_updown
81     servo_updown+=50
82     if servo_updown<=70 or servo_updown>=570:
83         warning()
84     else:
85         pwm.set_pwm(2,0,servo_updown)
86
87 ap=argparse.ArgumentParser()
88 #Provide a csv file, the QR code content can be displayed on the screen and asav
89 ap.add_argument("-o","--output",type=str,default="content.csv",
90                 help="path to output csv file containing barcode")
91 args=vars(ap.parse_args())
92
93 print('starting video stream....')
94 #Command of using web camera
95 vs=VideoStream(src=0).start()
96 #Command of using web Raspberry Pi's own camera
97 #vs=VideoStream(usePiCamera=True).start()
98 time.sleep(2.0)
99
100 #Write content to csv
101 csv=open(args["output"],"w")
102 found=set()
103 #Avoid congestion, multiple treatments
104 lastData=''
105 sendDate=0
106 while True:
107     frame=vs.read()
108     frame=imutils.resize(frame,width=400)
109     barcodes=pyzbar.decode(frame)
110     for barcode in barcodes:
111         (x,y,w,h)=barcode.rect
112
113         cv2.rectangle(frame,(x,y),(x+w,y+h),(0,0,255),2)
114         #Decode the contents of the QR code, enter the time, content and type
115         barcodeData=barcode.data.decode("utf-8")
116         barcodeType=barcode.type
117
118         text="{},{},{}".format(barcodeData,barcodeType)
119
120         cv2.putText(frame,text,(x,y-10),cv2.FONT_HERSHEY_SIMPLEX,0.5,
121                    (0,0,255),2)
122
123         newData=barcodeData
124         currentDate=time.time()
125         #Identify every three seconds, print out the incorrect information,
126         #If you want to add a new QR code, add a judgment.
127         if (currentDate-sendDate>3):
128             print('1')
129             if newData=='red_yello_blue light up':
130                 red_yellow_blue()
131                 sendDate=time.time()
132             elif newData=='right_left servo turn 0':
133                 left() #less than 500
134             elif newData=='right_left servo turn 180':
135                 right()
136             elif newData=='turn down':
137                 turn_down()
138             elif newData=='turn up':
139                 turn_up()
140             else : print('incorrect data:',newData)
141         else:
142             continue
143
144         if barcodeData not in found:
145             csv.write("{},{},{}\n".format(datetime.datetime.now(),barcodeData))
146             csv.flush()
147             found.add(barcodeData)
148         cv2.imshow("found_code",frame)
149         key=cv2.waitKey(1)&0xFF
150         if key==ord("q"):
151             break
152
153
154 csv.close()
155 cv2.destroyAllWindows()
156 vs.stop()
157

```



The second source code of the program is located at:

[/home/pi/Adafruit\\_Python\\_PCA9685/qrcode\\_speech.py](#)

```

1 #!/usr/bin/env python2
2  #-*- coding: utf-8 -*-
3  """
4
5      * @par Copyright (C): 2010-2019, Shenzhen Yahboom Tech
6      * @file      qrcode-speech
7      * @version    V1.0
8      * @details
9      * @par History
10
11      @author: longfuSun
12  """
13  from __future__ import division
14  from imutils.video import VideoStream
15  from pyzbar import pyzbar
16  import argparse
17  import datetime
18  import imutils
19  import time
20  import cv2
21  import RPi.GPIO as GPIO
22  import Adafruit_PCA9685
23  from aip import AipSpeech
24  import pygame
25  import threading
26
27
28  #Initialize baidu speech
29  APP_ID='14842692'
30  API_KEY='d06L3VtQCXr0qyL9PWGySGf0'
31  SECRET_KEY='ScxR70bkPQ1blfGzZGDGkBe5oobf0lDc'
32  #APP_ID='xxxxx'
33  #API_KEY='xxxxx'
34  #SECRET_KEY='xxxxx'
35  aipSpeech=AipSpeech(APP_ID,API_KEY,SECRET_KEY)
36
37  #Initialize gpio
38  GPIO.setmode(GPIO.BCM)
39  GPIO.setup(10,GPIO.OUT)
40  GPIO.setup(9,GPIO.OUT)
41  GPIO.setup(11,GPIO.OUT)

```

```

42 #Initialize servo
43 servo_updown=500
44 servo_rightleft=390
45 pwm = Adafruit_PCA9685.PCA9685()
46 pwm.set_pwm_freq(60)
47 pwm.set_pwm(0, 0, servo_rightleft)
48 pwm.set_pwm(1, 0, servo_updown)
49 #when the servo is over the allowable angle, buzzer will alarm
50 def warning():
51     GPIO.setup(16,GPIO.OUT)
52     GPIO.output(16,True)
53     time.sleep(1)
54     GPIO.output(16,False)
55
56 def motion_speech(content):
57     text=content
58     result = aipSpeech.synthesis(text = text,
59                                   options={'spd':5, 'vol':9, 'per':0,})
60     if not isinstance(result,dict):
61         with open('audio.mp3', 'wb') as f:
62             f.write(result)
63     else:print(result)
64     #Use Raspberry Pi own pygame
65     pygame.mixer.init()
66     pygame.mixer.music.load('/home/pi/Adafruit_Python_PCA9685/audio.mp3')
67     pygame.mixer.music.play()
68
69 #Water light
70 def red_yellow_blue():
71     content='红绿蓝小灯'
72     motion_speech(content)
73     for i in range(0,2):
74         GPIO.output(9,True)
75         time.sleep(0.1)
76         GPIO.output(10,True)
77         time.sleep(0.1)
78         GPIO.output(11,True)
79         time.sleep(0.1)
80         GPIO.output(10,False)

```

```

81     time.sleep(0.1)
82     GPIO.output(9,False)
83     time.sleep(0.1)
84     GPIO.output(11,False)
85 #Two degrees of freedom steering of the servo
86
87 def right():
88     content='伺服电机右转'
89     motion_speech(content)
90     global servo_rightleft
91     servo_rightleft-=50
92     if servo_rightleft<=170 or servo_rightleft>=570:
93         warning()
94     else :
95         pwm.set_pwm(1, 0, servo_rightleft)
96 def left():
97     content='伺服电机左转'
98     motion_speech(content)
99     global servo_rightleft
100    servo_rightleft+=50
101    if servo_rightleft<=170 or servo_rightleft>=570:
102        warning()
103    else :
104        pwm.set_pwm(1, 0, servo_rightleft)
105 def turn_down():
106     content='伺服电机向下'
107     motion_speech(content)
108     global servo_updown
109     servo_updown-=50
110     if servo_updown<=170 or servo_updown>=570:
111         warning()
112     else:
113         pwm.set_pwm(2,0,servo_updown)
114 def turn_up():
115     content='伺服电机向上'
116     motion_speech(content)
117     global servo_updown
118     servo_updown+=50
119     if servo_updown<=170 or servo_updown>=570:

```



```

120         warning()
121     else:
122         pwm.set_pwm(2, 0, servo_updown)
123
124 ap=argparse.ArgumentParser()
125 #Provide a csv file, the QR code content can be displayed on the screen and as a
126 ap.add_argument("-o", "--output", type=str, default="content.csv",
127                 help="path to output csv file containing barcode")
128 args=vars(ap.parse_args())
129
130 print('starting video stream...')
131 #Command of using web camera
132 vs=VideoStream(src=0).start()
133 #Command of using web Raspberry Pi's own camera
134 #vs=VideoStream(usePiCamera=True).start()
135 time.sleep(2.0)
136 #把内容写入csv
137 csv=open(args["output"], "w")
138 found=set()
139 #Avoid congestion, multiple treatments
140 lastData=''
141 sendDate=0
142 while True:
143     frame=vs.read()
144     frame=imutils.resize(frame,width=400)
145     barcodes=pyzbar.decode(frame)
146     for barcode in barcodes:
147         (x,y,w,h)=barcode.rect
148
149         cv2.rectangle(frame, (x,y), (x+w,y+h), (0,0,255), 2)
150         #Decode the contents of the QR code, enter the time, content and type
151         barcodeData=barcode.data.decode("utf-8")
152         barcodeType=barcode.type
153
154         text="{ }({})".format(barcodeData, barcodeType)
155
156         cv2.putText(frame, text, (x, y-10), cv2.FONT_HERSHEY_SIMPLEX, 0.5,
157                     (0,0,255), 2)
158
159         newData=barcodeData

```

```

160     currentDate=time.time()
161     #Identify every three seconds, print out the incorrect information,
162     #If you want to add a new QR code, add a judgment.
163     if (currentDate-sendDate>4):
164         print('1')
165         if newData=='red_yello_blue light up':
166             tid=threading.Thread(target=red_yellow_blue)
167             tid.setDaemon(True)
168             tid.start()
169             sendDate=time.time()
170         elif newData=='right_left servo turn 0':
171             tid=threading.Thread(target=left) #less than 500
172             tid.setDaemon(True)
173             tid.start()
174             sendDate=time.time()
175         elif newData=='right_left servo turn 180':
176             tid=threading.Thread(target=right)
177             tid.setDaemon(True)
178             tid.start()
179             sendDate=time.time()
180         elif newData=='turn down':
181             tid=threading.Thread(target=turn_down)
182             tid.setDaemon(True)
183             tid.start()
184             sendDate=time.time()
185         elif newData=='turn up':
186             tid=threading.Thread(target=turn_up)
187             tid.setDaemon(True)
188             tid.start()
189             sendDate=time.time()
190         else : print('incorrect data:',newData)
191     else:
192         continue
193
194     if barcodeData not in found:
195
196         csv.write("{}{}\n".format(datetime.datetime.now(),barcodeData))
197         csv.flush()
198         found.add(barcodeData)
199     cv2.imshow("found_code", frame)
200     key=cv2.waitKey(1)&0xFF
201     if key==ord("q"):
202         break
203 csv.close()
204 cv2.destroyAllWindows()
205 vs.stop()

```