Lesson 5 Obstacle Avoidance

1. Working Principle

Ultrasonic sensor can range the distance of front object and control the movement of car. If the distance of the front object exceeds the detected distance, the car will move forward; if the distance is less than the detected distance, the car will stop moving and turn to avoid the obstacle.

The source code of program is located in: /home/pi/MasterPi/Functions/Avoidance.py

```
165         return cv2.putText(img, "Dist:%.1fcm"%distance, (30, 480-30), cv2.FONT_HERSHEY_SIMPL
166
167
168     #processing before turning off
169     def Stop(signum, frame):
170         global __isRunning
171
172         __isRunning = False
173         print('turning off...')
174         chassis.set_velocity(0,0,0)
175
176     if __name__ == '__main__':
177         init()
178         start()
179         wheel = False
180         HWSONAR = Sonar.Sonar()
181         signal.signal(signal.SIGINT, Stop)
182         cap = cv2.VideoCapture('http://127.0.0.1:8080?action=stream')
183         while __isRunning:
184             ret,img = cap.read()
185             if ret:
186                 frame = img.copy()
187                 Frame = run(frame)
188                 frame_resize = cv2.resize(Frame, (320, 240))
189                 cv2.imshow('frame', frame_resize)
190                 key = cv2.waitKey(1)
191                 if key == 27:
192                     break
193             else:
194                 time.sleep(0.01)
195         cv2.destroyAllWindows()
```

2. Operation Steps

The entered command should be case sensitive. And the keywords can be complemented by Tab key.

1) Turn on MaserPi, then connect to Raspberry Pi system desktop through VNC.

2) Click or press "Ctrl+Alt+T" to enter LX terminal.

3) Enter "cd MasterPi/Functions/" command, and then press "Enter" to come to the category of games programs.

4) Enter "sudo python3 Avoidance.py", then press "Enter" to start game.

5) If you want to exit the game program, press "Ctrl+C" in LX terminal interface. If the exit fails, please try it few more times.

3. Project Outcome

After starting game, the distance of ranged object will be displayed on the transmitted screen. When the distance between car and detected object is less than 30cm, the car will stop moving; when the distance is more than 30cm, the car will move forward.

4. Function Extension

4.1 Modify distance threshold

The distance threshold defaults to 30cm. If want to modify the distance threshold, you can refer to the following steps to modify. This section will modify the distance between MasterPi and detected object to less than or equal to 20cm, and then turn left.

1) Enter "cd MasterPi/Functions/" command to the directory where the game programs are located.

2) Enter command "sudo vim Avoidance.py", and then press "Enter" to open program file.

3) Find the code shown in the following red box:

Note: After entering the position number of code, press "Shift+G" to jump to the corresponding position. (The position number of the code in figure is for reference only.)

4) Press "i" key to enter the editing mode.

5) Modify "30.0" in "Threshold = 30.0" to "20.0" as the figure shown below:

6) After the modification is complete, press "Esc". Then enter ":wq" and press "Enter" to save and exit.

7) Refer to the operation steps in "2.Operation Steps" to start game. MasterPi will turn left when the distance between MasterPi and object is less than or equal to 20cm.

4.2 Modify Speed

If want to modify the car speed, you can modify it according to the following steps. This section will modify speed to 20 as an example.

1) Enter "cd MasterPi/Functions/" command to the directory of game programs.

2) Enter "sudo vim Avoidance.py" command, and then press "Enter" to open program file.

3) Find the code shown in the following red box.

Note: After entering the position number of code, press "Shift+G" to jump to the corresponding position. (The position number of the code in figure is for reference only.)

4) Press "i" on keyboard. Then enter the editing mode when the word "INSERT" appears.

5) Modify "40" in "speed = "40" to "20" as the figure shown below:

```
19 AK = ArmIK()
20 chassis = mecanum.MecanumChassis()
21
22 if sys.version_info.major == 2:
23     print('Please run this program with python3!')
24     sys.exit(0)
25
26 HWSONAR = None
27 Threshold = 30.0
28 TextColor = (0, 255, 255)
29 TextSize = 12
30
31 speed = 20
32 __isRunning = False
33 __until = 0
```

6) After the modification is complete, press "Esc". Then enter ":wq" and press "Enter" to save and exit.

```
137         data_c = data[np.abs(data - u) <= std]
138         distance = data_c.mean()[0]
139
140         if len(distance_data) == 5:
:wq
```

7) According to "2.Operation Steps" to start the game again, MasterPi will move at the speed of 20.