

智慧機器人V12

使用手冊



目錄

1 智慧機器人組件

2 智慧機器人系統資訊

3 注意事項

4 技術資源

5 智慧機器人電源啟動順序

6 鍵盤遙控智慧機器人

7 智慧機器人影像傳輸

8 智慧機器人影像辨識道路

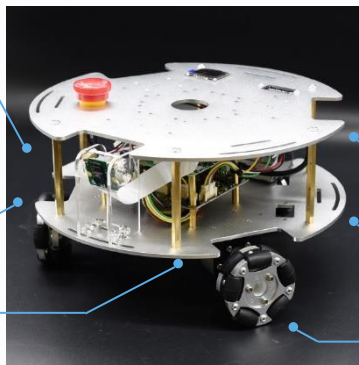
註：6、8、8項操作為基本使用方法
進階操作或相關課程
請洽創客菜吧 Makerlab
電話：08－5564686
官網：<https://www.makerlab.tw/>

1.智慧機器人組件

支援1080p 鏡頭

鋰電池

鋁合金底板



單板電腦 – 樹梅派

Ominibot 馬達控制器

全向輪 * 3



無線通訊

擁有wifi與藍芽



搭載ROS系統

使用強大的機器人
操作系統



電源管理

Ominibot 馬達控制
版提供 兩組
5V/4A的電源埠



影像辨識

能夠於線道中
自動駕駛

2.智慧機器人系統資訊

作業系統、帳號名稱與密碼



- ✓ 作業系統：Ubuntu-mate 16.04
- ✓ 預設帳號與主機名稱
 - ubuntu@smartrobot
- ✓ 預設密碼
 - 創客萊吧之電話號碼：5564686

3.注意事項

良好的使用方法有助於延長使用時間



1

2

單板電腦－樹梅派 3B

常插拔的兩個地方需要小心謹慎

1. Micro USB 電源供應孔
2. HDMI 螢幕孔



馬達控制器

未使用智慧機器人時，請記得將所有電源關閉(確保未有指示燈亮起)，以延長鋰電池使用期限



鋰電池與充電器

充電時需有人在現場檢視，充電完畢需即時停止充電，禁止於夜晚充電至隔天早上

4.技術資源

創客萊吧 Makerlab 已於 github 開放原始碼：https://github.com/kjoelovelife/smart_robot

■ audio_common_dependency	modified dependencies for audio_common
■ catkin_ws	Update smart_robot_twist.py
📄 README.md	Update README.md
📄 calibration_pattern.pdf	add calibration_pattern/pdf
📄 dependencies_for_laptop.sh	modified dependencies_for_laptop and pi
📄 dependencies_for_smartRobot_pi_ws_tools.sh	Update dependencies_for_smartRobot_pi_ws_tools.sh
📄 set_ros_master.sh	Update set_ros_master.sh
📄 smart_robot.jpg	picture for smart robot
📄 ssh_setup.sh	add dependencies_for_laptop and ssh_setup.sh
📄 uno.rules	first commit

Introduction

This repository contains all the software that runs on the Smart robot, makerlab design.

- makerlab : <https://www.makerlab.tw/>

Smart robot is a low-cost platform base on raspberry pi 3, comes with rpi3 official camera, wide-angle lens, and is a Omron wheels drive.

reference

Turtlebot3 e-Manual : http://emanual.robotis.com/docs/en/platform/turtlebot3/autonomous_driving/turtlebot3-autonance

pocketphinx setup : <https://github.com/cmuphinx/pocketphinx-python>

ROS and pocketphinx (source) : <https://github.com/UTNuclearRoboticsPublic/pocketphinx>

ROS and pocketphinx (blog) : <http://blog.michaels.net/2017/03/raspberry-pi-3-pocketphinxnode.html>

Another module of language :

<https://tw.sown.com/a/691d0d1f77ba19c497c54e636c5c4e821a64088a99070397e81c550be4>

讓你能夠更方便地使用智慧機器人

IcShop 將需要使用到的知識與技術，
通通幫你整合在開放的 github 上，
讓你使用起來更加方便

5. 智慧機器人電源啟動順序

使用智慧機器人前的預備動作



1. 樹莓派接入 HDMI 螢幕線與螢幕連線



2. 確保緊急按鈕為拉起狀態



3. 將 Ominibot 馬達控制版電源開啟

6、鍵盤遙控智慧機器人

6-1 執行



文件檔案

指令：`roslaunch driver teleop_smartrobotv12.launch`

```
icshop@knightcar: ~  
File Edit Tabs Help  
Activating ROS...  
...done.  
Setting up PYTHONPATH.  
Setup ROS_HOSTNAME.  
Setting ROS_MASTER_URI...  
No hostname provided. Using knightcar.  
ROS_MASTER_URI set to http://knightcar.local:11311/  
Your IP address:  
icshop@knightcar:~$ roslaunch driver teleop_smartrobotv12.launch
```


6、鍵盤遙控智慧機器人

6-2 在執行



節點的 Terminal，按下 w/x/s/a/d

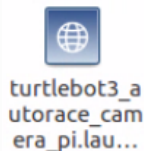
即可移動智慧機器人

```
ubuntu@smartrobot: ~  
File Edit View Search Terminal Tabs Help  
roscore http://192.168.3.75:11311/ x ubuntu@smartrobot: ~ x  
-----  
Control Your smartrobot!  
-----  
Moving around:  
  w  
  a  s  d  
  x  
  
w/x : increase/decrease linear velocity ( ~ 4)  
a/d : increase/decrease angular velocity (~ 10)  
  
space , s : force stop  
  
CTRL-C to quit  
  
currently: linear vel 2.0 angular vel 0.0  
currently: linear vel 4.0 angular vel 0.0  
currently: linear vel 6.0 angular vel 0.0  
currently: linear vel 8.0 angular vel 0.0  
currently: linear vel 10.0 angular vel 0.0  
currently: linear vel 12.0 angular vel 0.0  
currently: linear vel 14.0 angular vel 0.0
```

按鍵	移動方向
W	前進
X	後退
A	逆時針旋轉
D	順時針旋轉
S	停止

7、智慧機器人影像傳輸

7-1 執行



launch文件檔案

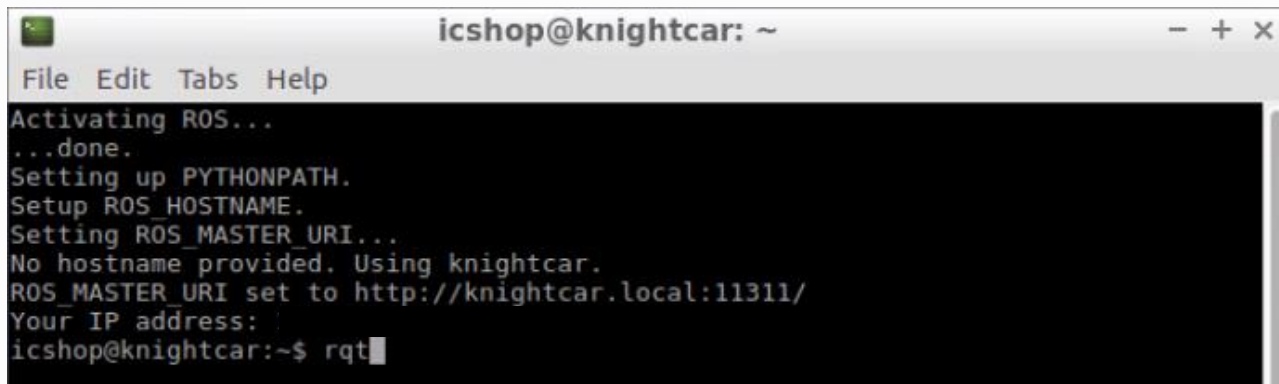
指令：`roslaunch turtlebot3_aurorace_camera turtlebot3_aurorace_camera_pi.launch`

```
/home/icshop/smart_robot/catkin_ws/s...pi.launch http://knightcar.local:11311/ - + x
File Edit Tabs Help
Activating ROS...
...done.
Setting up PYTHONPATH.
Setup ROS_HOSTNAME.
Setting ROS_MASTER_URI...
No hostname provided. Using knightcar.
ROS_MASTER_URI set to http://knightcar.local:11311/
Your IP address:
icshop@knightcar:~$ roslaunch turtlebot3_aurorace_camera turtlebot3_aurorace_camera_pi.launch
```

7、智慧機器人影像傳輸

7-2 執行可視化工具 rqt

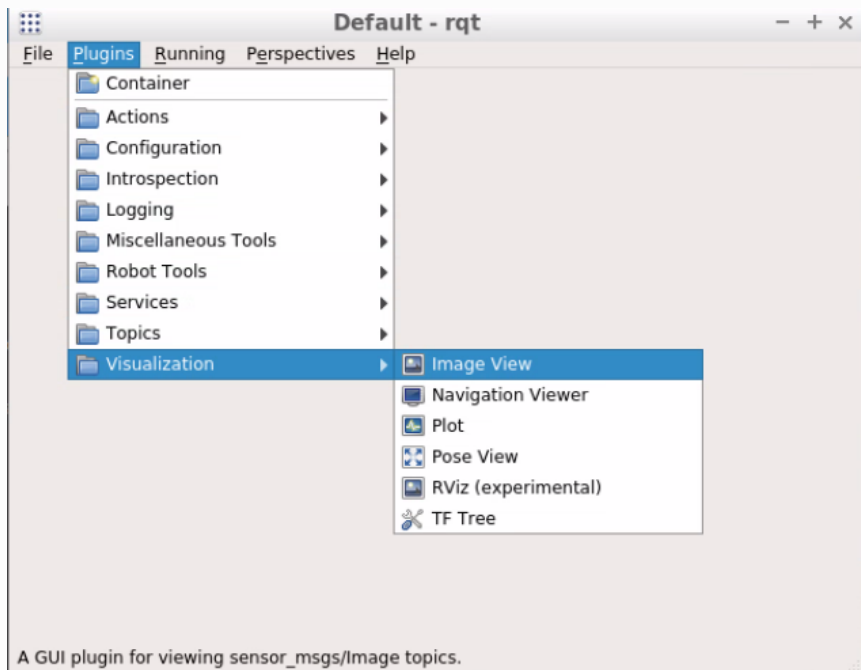
指令：`rqt`



```
icshop@knightcar: ~  
File Edit Tabs Help  
Activating ROS...  
...done.  
Setting up PYTHONPATH.  
Setup ROS_HOSTNAME.  
Setting ROS_MASTER_URI...  
No hostname provided. Using knightcar.  
ROS_MASTER_URI set to http://knightcar.local:11311/  
Your IP address: |  
icshop@knightcar:~$ rqt
```

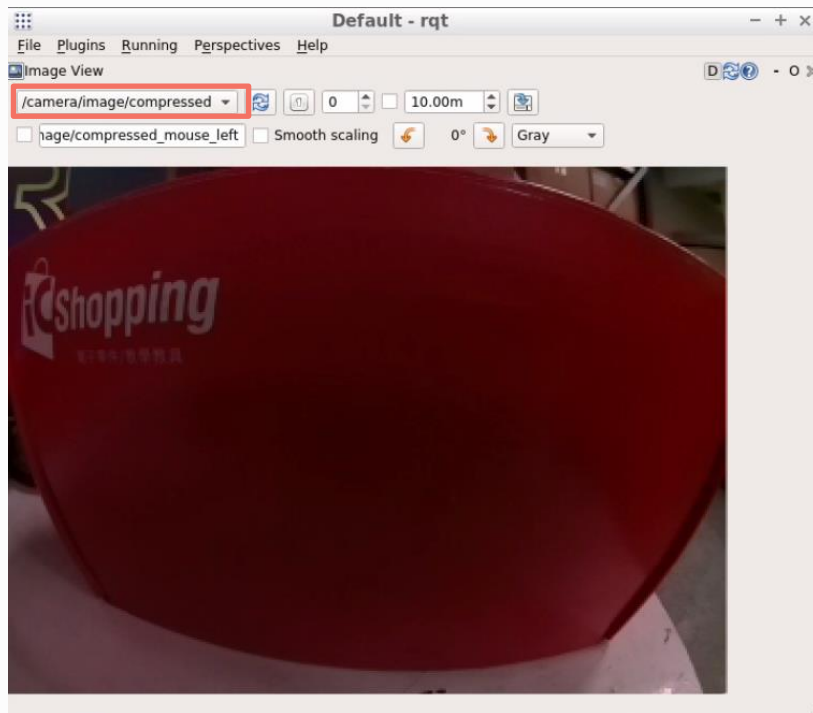
7、智慧機器人影像傳輸

7-3 開啟工具 Image_view



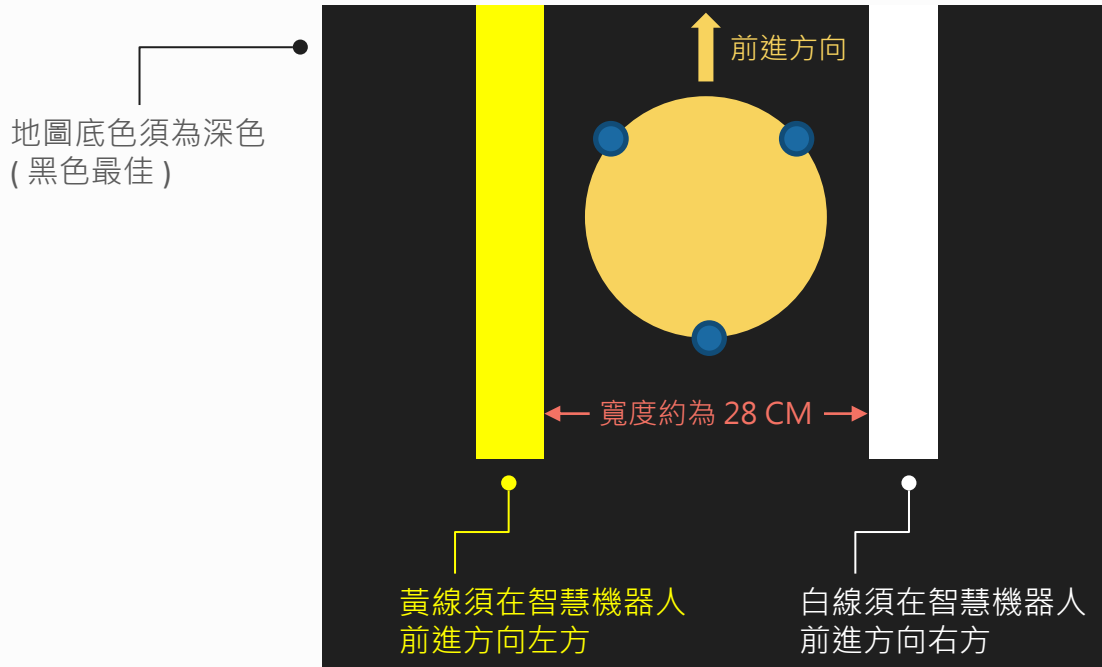
7、智慧機器人影像傳輸

7-4 選擇 Topic “/camera/image/compressed”



8、智慧機器人影像辨識道路

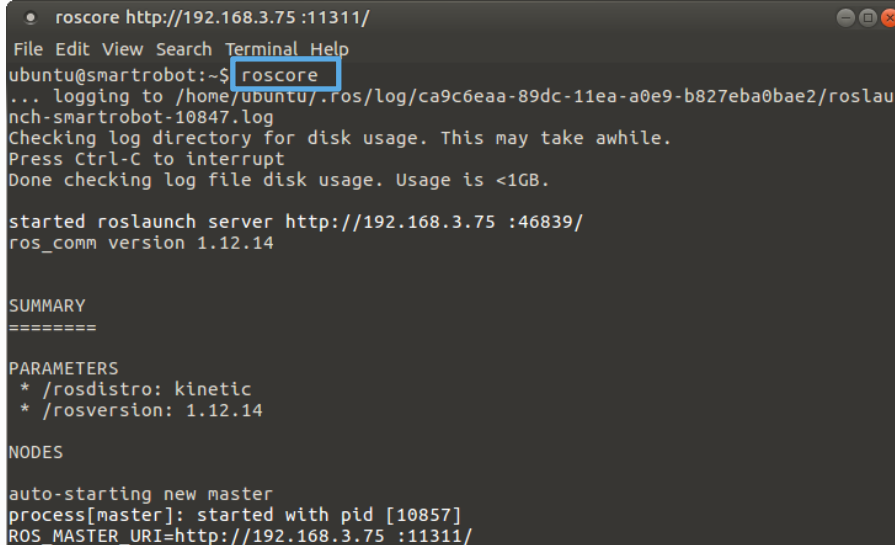
8-1 準備好地圖與智慧機器人



8、智慧機器人影像辨識道路

8-2 註冊 Master

指令：`roscore`



```
roscore http://192.168.3.75:11311/
File Edit View Search Terminal Help
ubuntu@smartrobot:~$ roscore
... logging to /home/ubuntu/.ros/log/ca9c6eaa-89dc-11ea-a0e9-b827eba0bae2/roslau
nch-smartrobot-10847.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.3.75:46839/
ros_comm version 1.12.14

SUMMARY
=====

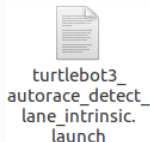
PARAMETERS
* /rostdistro: kinetic
* /rosversion: 1.12.14

NODES

auto-starting new master
process[master]: started with pid [10857]
ROS_MASTER_URI=http://192.168.3.75:11311/
```


8、智慧機器人影像辨識道路

8-3 執行



文件

指令：`roslaunch turtlebot3_autorace_camera turtlebot3_autorace_detect_lane_intrinsic.launch`

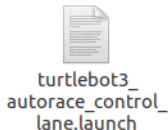
```
• /home/ubuntu/smart_robot/catkin_ws/src/turtlebot3_autorace/turtlebot3_autorace_camera/launch/turtlebot3_autorace_
File Edit View Search Terminal Tabs Help
roscore http://192.168.3.75:11311/ * /home/ubuntu/smart_robot/catkin_ws/... * ubuntu@smartrobot: ~
ubuntu@smartrobot:~$ roslaunch turtlebot3_autorace_camera turtlebot3_autorace_detect_lane_intrinsic.launch
... logging to /home/ubuntu/.ros/log/0518a8c2-89de-11ea-b8de-b827eb0b0ae2/ros-launch-smartrobot-2857.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.3.75:36876/

SUMMARY
=====
PARAMETERS
* /camera/camera/ISO: 244
* /camera/camera/awb_mode: tungsten
* /camera/camera/brightness: 78
* /camera/camera/contrast: 11
* /camera/camera/exposureCompensation: 0
* /camera/camera/exposure_mode: antishake
* /camera/camera/hFlip: False
* /camera/camera/saturation: 37
* /camera/camera/sharpness: 34
* /camera/camera/shutterSpeed: 10000
* /camera/camera/vFlip: False
* /camera/camera/videoStabilisation: False
```

8、智慧機器人影像辨識道路

8-4 執行



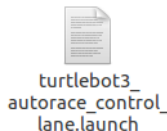
文件

指令：`roslaunch turtlebot3_aurace_control turtlebot3_aurace_control_lane.launch`

```
ubuntu@smartrobot: ~  
File Edit View Search Terminal Tabs Help  
roscore http://192.168.3.75:11311/ ✖ /home/ubuntu/smart robot/catkin ws/... ✖ ubuntu@smartrobot: ~ ✖  
ubuntu@smartrobot:~$ roslaunch turtlebot3_aurace_control turtlebot3_aurace_control_lane.launch  
... logging to /home/ubuntu/.ros/log/65f080c2-63d-11e6-b0de-b027eb060e2/ros-ubuntu-smartrobot-3444.log  
Checking log directory for disk usage. This may take awhile.  
Press Ctrl-C to interrupt  
Done checking log file disk usage. Usage is <1GB.  
  
started roslaunch server http://192.168.3.75 :36809/  
  
SUMMARY  
=====  
  
PARAMETERS  
* /camera/image_compensation/camera/extrinsic_camera_calibration/clip_hist_percent: 8.0  
* /camera/image_compensation/is_extrinsic_camera_calibration_mode: False  
* /camera/image_compensation_projection/camera/extrinsic_camera_calibration/clip_hist_percent: 8.0  
* /camera/image_compensation_projection/is_extrinsic_camera_calibration_mode: False  
* /camera/image_projection/camera/extrinsic_camera_calibration/bottom_x: 273  
* /camera/image_projection/camera/extrinsic_camera_calibration/bottom_y: 130  
* /camera/image_projection/camera/extrinsic_camera_calibration/top_x: 103  
* /camera/image_projection/camera/extrinsic_camera_calibration/top_y: 66  
* /camera/image_projection/is_extrinsic_camera_calibration_mode: False  
* /desired_center: 200  
* /detect_lane/detect/lane/white/hue_h: 179  
* /detect_lane/detect/lane/white/hue_l: 0
```

8、智慧機器人影像辨識道路

8-4-1 執行



文件出現紅字

```
process[camera/image_compensation-1]: started with pid [21423]
process[camera/image_projection-2]: started with pid [21424]
process[camera/image_compensation_projection-3]: started with pid [21425]
process[detect_lane-4]: started with pid [21426]
process[control_lane-5]: started with pid [21427]
[ERROR] [1558634990.281916]: bad callback: <bound method DetectLane.cbFindLane of <__main__.DetectLane
  instance at 0x7feb3fbc8c0>
  >
  File "/opt/ros/kinetic/lib/python2.7/dist-packages/rospy/topics.py", line 750, in _invoke_callback
    cb(msg)
  File "/home/icshopedu/smart_robot/catkin_ws/src/turtlebot3_autorace/turtlebot3_autorace_detect/node
s/detect_lane", line 179, in cbFindLane
    self.left_fit = np.array([np.mean(self.mov_avg_left[:-1]), 0][0:MOV_AVG_LENGTH]),
AttributeError: DetectLane instance has no attribute 'mov_avg_left'

[ERROR] [1558634990.414298]: bad callback: <bound method DetectLane.cbFindLane of <__main__.DetectLane
  instance at 0x7feb3fbc8c0>
  >
  File "/opt/ros/kinetic/lib/python2.7/dist-packages/rospy/topics.py", line 750, in _invoke_callback
    cb(msg)
  File "/home/icshopedu/smart_robot/catkin_ws/src/turtlebot3_autorace/turtlebot3_autorace_detect/node
s/detect_lane", line 179, in cbFindLane
    self.left_fit = np.array([np.mean(self.mov_avg_left[:-1]), 0][0:MOV_AVG_LENGTH]),
AttributeError: DetectLane instance has no attribute 'mov_avg_left'
```

若是出現紅色字體

表示智慧機器人不在正確的線道上

請回到 [8-1 步驟](#)

確認地圖與智慧機器人擺放位置是否正確

若擺放正確則紅色字體不會再被刷新

8、智慧機器人影像辨識道路

8-5 執行



smart_robot_twist.
py

節點，開始移動

指令：`roslaunch driver smart_robot_twist_omnibotV12.py`

```
ubuntu@smartrobot: ~  
File Edit View Search Terminal Tabs Help  
roscore http://192.168.3.75:4567/ x ubuntu@smartrobot: ~ x ubuntu@smartrobot: ~ x  
ubuntu@smartrobot:~$ roslaunch driver smart_robot_twist_omnibotV12.py  
  
Control Smart Robot !  
-----  
  
      x  
      ^  
      |  
  ^   | motor2      motor 1 ^  
  |   |             |  
  y <-----|  
             |  
      motor3  
      -->  
  
-----  
w: Go  
s: Stop
```

8、智慧機器人影像辨識道路

8-6 修改



automove.yaml

參數，調整影像辨識道路行進路線

位置：

smart_robot catkin_ws src turtlebot3_autorace turtlebot3_autorace_control param control_lane

```
automove.yaml (~/.smart_robot/catkin_ws/src/turtlebot3_autorace/turtlebot3_autorace_control/param/control_lane)
Open Save
kp: 0.0001 # default:0.0001 , range 0.00001 ~ 0.0025
kd: 0.0007 # default:0.007 , range 0.001 ~ 0.0001
y_max_speed: 30 # default:30 , range 0 ~ 126
z_max_speed: 40 # default:40 , range 0 ~ 126
desired_center: 200 # default:500 , range: 0 ( yellow ) ~ 599 ( white )
```