無人機智慧系統開發與實作
System Development and Implementation of Drone Intelligence

ROS & DJI Tello Driver

Install Tello Driver

Installation

- `$ cd <CATKIN_WS/SRC>`
- `$ git clone https://github.com/anqixu/TelloPy.git`
- `$ cd TelloPy`
- `$ sudo -H pip2 install -e .`
- `$ cd ..`
- `$ git clone https://github.com/anqixu/h264_image_transport.git`
- `$ git clone https://github.com/anqixu/tello_driver.git`
- `$ cd ..`
- `$ rosdep install h264_image_transport`
- skip this step: `$ # rosdep install tello_driver # not working currently`
- `$ catkin build tello_driver`

https://github.com/anqixu/tello_driver

Running Driver

1. 開啟tello，並讓筆電與tello連線
2. 開啟終端機
3. roslaunch tello_driver tello_node.launch

```
kslab@kslab-ESC500-G4:~/catkin_ws$ roslaunch tello_driver tello_node.launch
WARNING: Package name "intelAero_test" does not follow the naming conventions. I
t should start with a lower case letter and only contain lower case letters, dig
its, underscores, and dashes.
... logging to /home/kslab/.ros/log/0bf65f04-4303-11e9-88c0-88d7f6aea919/roslaun
ch-kslab-ESC500-G4-14414.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://kslab-ESC500-G4:44583/

SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.14
 * /tello/tello/connect_timeout_sec: 10.0
 * /tello/tello/local_cmd_client_port: 8890
 * /tello/tello/local_vid_server_port: 6038
 * /tello/tello/stream_h264_video: False
 * /tello/tello/tello_cmd_server_port: 8889
 * /tello/tello/tello_ip: 192.168.10.1

NODES
  /tello/
    image_compressed (image_transport/republish)
    tello (tello_driver/tello_driver_node.py)

auto-starting new master
process[master]: started with pid [14424]
ROS_MASTER_URI=http://localhost:11311

setting /run_id to 0bf65f04-4303-11e9-88c0-88d7f6aea919
WARNING: Package name "intelAero_test" does not follow the naming conventions. I
t should start with a lower case letter and only contain lower case letters, dig
its, underscores, and dashes.
process[rosout-1]: started with pid [14437]
started core service [/rosout]
process[tello/tello-2]: started with pid [14448]
process[tello/image_compressed-3]: started with pid [14455]
[INFO] [1552201598.796880]: Connecting to drone @ 192.168.10.1:8889
[INFO] [1552201600.866847]: Connected to drone
[INFO] [1552201600.943249]: Tello driver node ready
```

Running Driver

rosnode list

```
kslab@kslab-ESC500-G4:~/catkin_ws$ rosnode list
/rosout
/tello/image_compressed
/tello/tello
```

rostopic list

```
kslab@kslab-ESC500-G4:~/catkin_ws$ rostopic list
/rosout
/rosout_agg
/tello/cmd_vel
/tello/fast_mode
/tello/flattrim
/tello/flip
/tello/image_raw
/tello/image_raw/compressed
/tello/image_raw/compressed/parameter_descriptions
/tello/image_raw/compressed/parameter_updates
/tello/land
/tello/palm_land
/tello/status
/tello/takeoff
/tello/tello/parameter_descriptions
/tello/tello/parameter_updates
/tello/throw_takeoff
```

`~cmd_vel` : geometry_msgs/Twist

`~fast_mode` : std_msgs/Empty

`~image_raw` : sensor_msgs/Image

`~takeoff` : std_msgs/Empty

`~throw_takeoff` : std_msgs/Empty

`~land` : std_msgs/Empty

`~palm_land` : std_msgs/Empty

`~flattrim` : std_msgs/Empty

`~flip` : std_msgs/Uint8

First ROS PROGRAMMING

```
#!/usr/bin/env python
import rospy
import roslib
import sys
from geometry_msgs.msg import Twist
from std_msgs.msg import Empty
from time import sleep

global cont
cont = True
```

```
def TO():
  takeoff_pub = rospy.Publisher('/tello/takeoff', Empty, queue_size = 1)
  rospy.init_node('turtlesim_pub', anonymous=True)
  rate = rospy.Rate(10)
  msg = Empty()
  rospy.loginfo(msg)
  takeoff_pub.publish(msg)
  rate.sleep()
```

First ROS PROGRAMMING

```
def cmd():
  #The queue_size argument is New in ROS hydro and limits the amount of queued messages if any subscriber is not receiving them fast enough

  cmd_pub = rospy.Publisher('/tello/cmd_vel', Twist, queue_size = 10)
  rate = rospy.Rate(10)
  count = 10
  while not rospy.is_shutdown():
    if count > 0:
      msg = Twist()
      msg.linear.x = 0.4
      msg.angular.z = 0.36
      rospy.loginfo(msg)
      cmd_pub.publish(msg)
      rate.sleep()
      count -= 1
    else:
      #msg = Twist()
      #cmd_pub.publish(msg)
      #rate.sleep()
      break
  print("end loop")
  sleep(3)
```

First ROS PROGRAMMING

```
def L():
  global cont
  land_sub = rospy.Subscriber('/tello/land', Empty, callback)
  land_pub = rospy.Publisher('/tello/land', Empty, queue_size = 1)
  rate = rospy.Rate(10)

  while cont == True:
    msg = Empty()
    #rospy.loginfo(msg)
    land_pub.publish(msg)
    rate.sleep()
```

```
def callback(data):
  global cont
  if data:
    cont = False
```

First ROS PROGRAMMING

```
if __name__ == '__main__':
  try:
    TO()
    sleep(3)
    cmd()
    sleep(3)
    L()
  except rospy.ROSInterruptException:
    pass
  finally:
    sys.exit(0)
```

image for tello

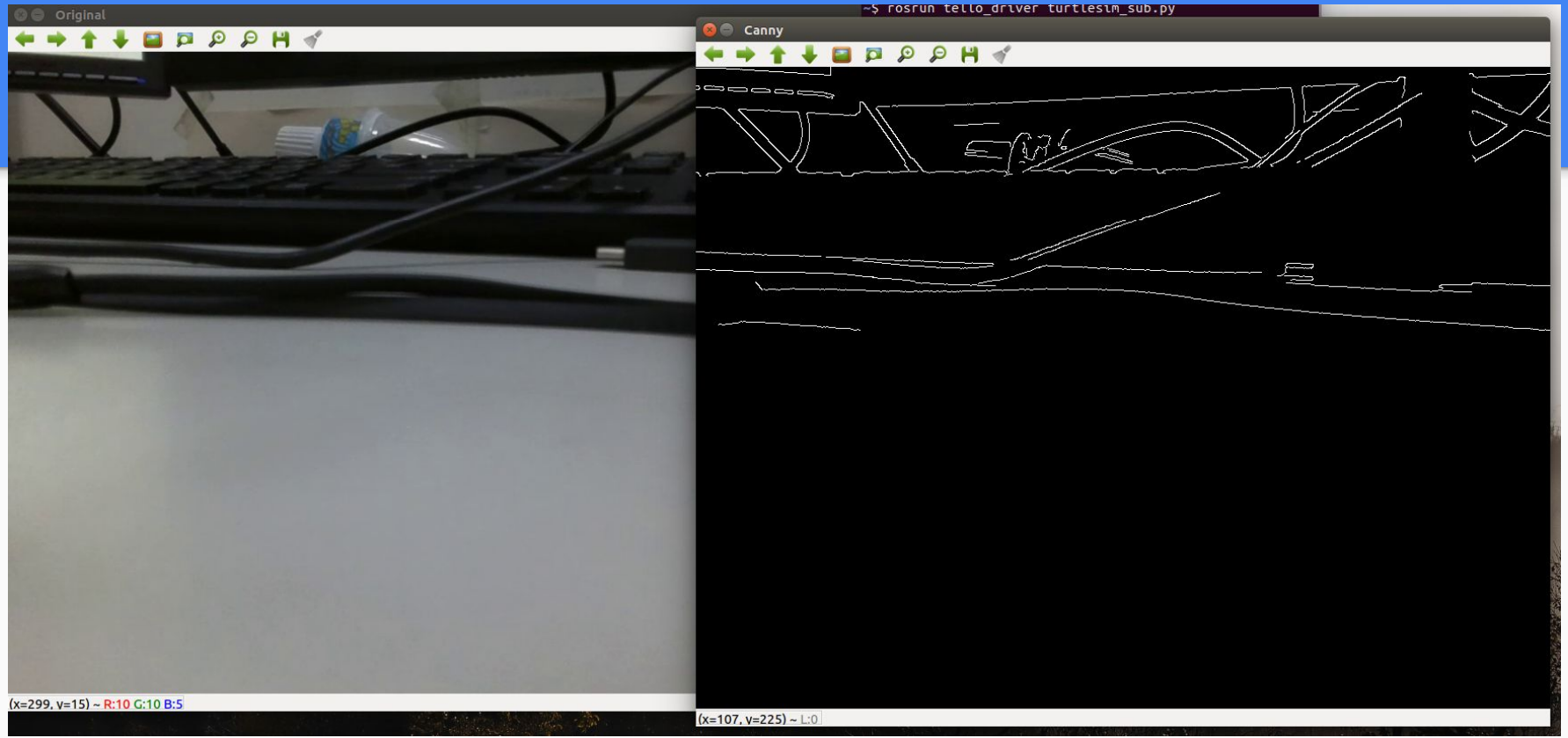
/tello/image_raw

sensor_msgs/Image

```
kslab@kslab-ESC500-G4:~$ rosmsg show sensor_msgs/Image
WARNING: Package name "intelAero_test" does not follow the naming conventions. I
t should start with a lower case letter and only contain lower case letters, dig
its, underscores, and dashes.
std_msgs/Header header
  uint32 seq
  time stamp
  string frame_id
uint32 height
uint32 width
string encoding
uint8 is_bigendian
uint32 step
uint8[] data
```

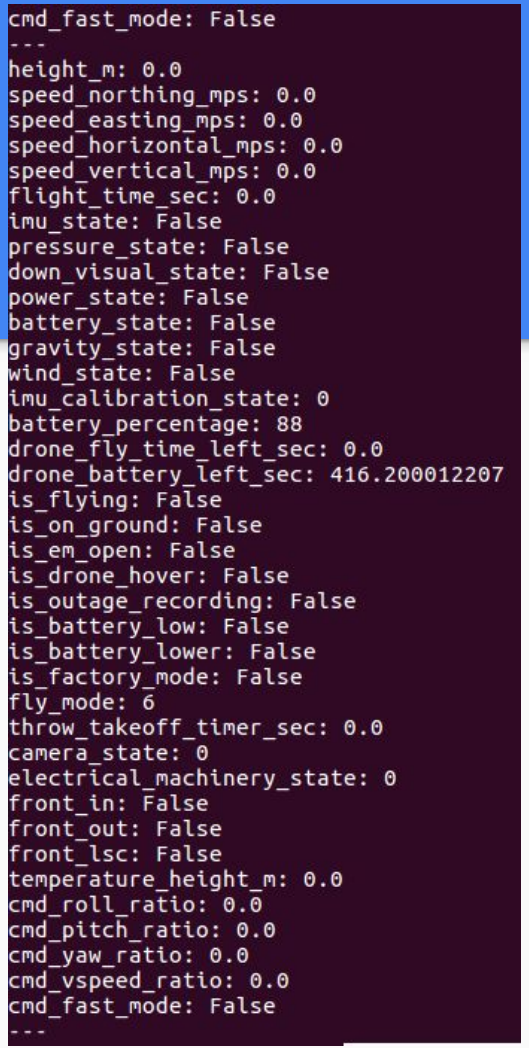
CvBridge

```python
#!/usr/bin/env python
import rospy
import roslib
import cv2
import numpy as np

from cv_bridge import CvBridge, CvBridgeError
from sensor_msgs.msg import Image

def callback(data):
  bridge = CvBridge()
  try:
    img = bridge.imgmsg_to_cv2(data, "bgr8")
  except CvBridgeError as e:
    print(e)

  cv2.imshow('Original', img)
  cv2.imshow('Canny', cv2.Canny(img, 100, 200))
  cv2.waitKey(1)

def turtle_sub():
  rospy.init_node('turtlesim_sub', anonymous=True)
  rospy.Subscriber("/tello/image_raw", Image, callback)
  # spin() simply keeps python from exiting until this node is stopped
  rospy.spin()

if __name__ == '__main__':
  turtle_sub()
```


Original
~$ rosrun tello_driver turtlesim_sub.py
Canny
(x=299, v=15) ~ R:10 G:10 B:5
(x=107, v=225) ~ L:0

tello status

rostopic echo /tello/status



自定義msg

~/catkin_ws/src/tello_driver/msg

```
# Non-negative; calibrated to takeoff altitude; auto-calib if falls below takeoff height; inaccurate near ground
float32 height_m

float32 speed_northing_mps
float32 speed_easting_mps
float32 speed_horizontal_mps
float32 speed_vertical_mps

float32 flight_time_sec

bool imu_state
bool pressure_state
bool down_visual_state
bool power_state
bool battery_state
bool gravity_state
bool wind_state

uint8 imu_calibration_state
uint8 battery_percentage
float32 drone_fly_time_left_sec
float32 drone_battery_left_sec

bool is_flying
bool is_on_ground
# is_em_open True in flight, False when landed
bool is_em_open
bool is_drone_hover
bool is_outage_recording
bool is_battery_low
bool is_battery_lower
bool is_factory_mode

# flymode=1: landed; =6: flying
uint8 fly_mode
float32 throw_takeoff_timer_sec
uint8 camera_state
```

自定義msg

create test.msg

```
Header header

float32[] l1
float32[] l2
```

cd ~/catkin_ws

catkin build tello_driver

rosmsg show tello_driver/test

```
kslab@kslab-ESC500-G4:~/catkin_ws$ rosmsg show tello_driver/test
WARNING: Package name "intelAero_test" does not follow the naming conventions. I
t should start with a lower case letter and only contain lower case letters, dig
its, underscores, and dashes.
std_msgs/Header header
  uint32 seq
  time stamp
  string frame_id
float32[] l1
float32[] l2
```

how to use 自定義msg in rospy

from tello_driver.msg import TelloStatus

from tello_driver.msg import test

自定義topic

rospy.Subscriber("/selfDefined", UInt8, secallback)

```
kslab@kslab-ESC500-G4:~$ rostopic list
/rosout
/rosout_agg
/selfDefined
/tello/cmd_vel
/tello/fast_mode
/tello/flattrim
/tello/flip
/tello/image_raw
/tello/image_raw/compressed
/tello/image_raw/compressed/parameter_descriptions
/tello/image_raw/compressed/parameter_updates
/tello/land
/tello/palm_land
/tello/status
/tello/takeoff
/tello/tello/parameter_descriptions
/tello/tello/parameter_updates
/tello/throw_takeoff
```

自定義topic

```
def L():
  global cont
  land_sub = rospy.Subscriber('/tello/land', Empty, callback)
  land_pub = rospy.Publisher('/tello/land', Empty, queue_size = 1)
  self_pub = rospy.Publisher('/selfDefined', UInt8, queue_size = 1)
  rate = rospy.Rate(10)


  while cont == True:
    if cont == True:
      self_pub.publish(1)
      rate.sleep()

    sleep(3)
    msg = Empty()
    rospy.loginfo(msg)
    land_pub.publish(msg)
    rate.sleep()

  self_pub.publish(0)
  rate.sleep()
```

自定義topic

```
global choose
choose = -2

def secallback(data):
  global choose
  #print(data.data)
  choose = data.data
```

```
def turtle_sub():
  rospy.init_node('turtlesim_sub', anonymous=True)
  rospy.Subscriber("/tello/image_raw", Image, callback)
  rospy.Subscriber("/selfDefined", UInt8, secallback)
  # spin() simply keeps python from exiting until this node is stopped
  rospy.spin()
```

自定義topic

```python
def callback(data):
  global choose
  bridge = CvBridge()
  try:
    img = bridge.imgmsg_to_cv2(data, "bgr8")
  except CvBridgeError as e:
    print(e)
  #print(img.shape)
  cv2.imshow('Original', img)
  pp = img.copy()
  if choose == -2:
    pp = cv2.Canny(pp, 100, 200)
  elif choose == 0:
    pp = cv2.cvtColor(pp, cv2.COLOR_BGR2GRAY)
  elif choose == 1:
    _, pp = cv2.threshold(pp,127,255,cv2.THRESH_BINARY)

  cv2.imshow('choose', pp)
  out.write(pp)
  cv2.waitKey(1)
```

```python
title = datetime.now().strftime('%Y-%m-%d %H:%M:%S')
fourcc = cv2.VideoWriter_fourcc(*'XVID')
out = cv2.VideoWriter(title + '_video.avi', fourcc, 20,(960, 720))
```

H264_packet

tello_node.launch

```
<param name="stream_h264_video" value="True" />
```

```
rospy.Subscriber("/tello/image_raw/h264", H264Packet, callback)
```

run

test_h264_sub.py