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

DJI Tello

DJI Tello:
飛行器

重量: 80g(含槳葉與電池)

尺寸: 98*92.5*41 mm

槳葉: 3英吋

內置功能: 紅外線定高，氣壓計定高，LED 指示燈，下視視覺，Wi-Fi 連接，高清 720P 影像

接口: Micro USB 充電接口

可拆卸電池: 1.1Ah/3.8V

DJI Tello:
飛行性能

最大飛行距離: 100 米

最大飛行速度: 8m/s

最大飛行時間: 13 分鐘

最大飛行高度: 30 米

DJI Tello:
相機

照片: 500 萬像素

FOV: 82.6°

影片: HD720P30

格式: JPG（照片），MP4（影片）

電子防抖: 支援

DJI Tello:
既有功能

掌上抛飛

全向翻滾

彈跳模式

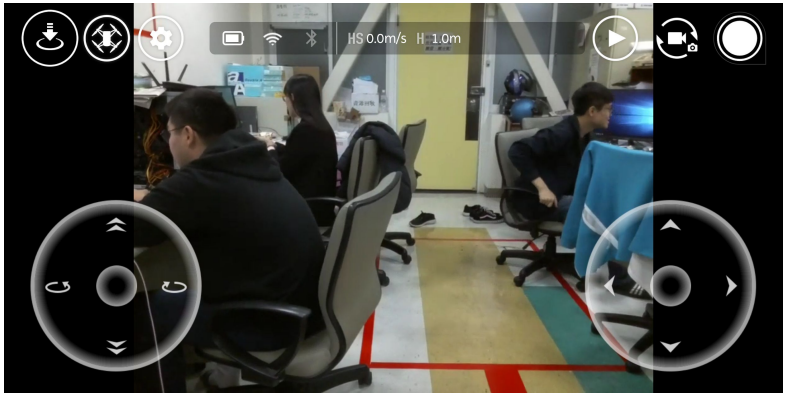
手掌降落

定點環繞

原地360度環繞

一件飛遠模式

DJI Tello: control App



https://play.google.com/store/apps/details?id=com.ryzerobotics.tello&hl=zh_TW

DJI Tello:
How to connect?

1. 裝上電池，開啟Tello(開機按鈕於機身側面)

2. 開機後，確認Tello 前方之LED燈是否亮起並閃爍

3. 使用筆電 or 手機連接wifi: TELLO-XXXXXX
(XXXX因機型而不同，飛機上應貼有對應的便條)

DJI Tello:
First Programming

1. Install python latest(2.7 or 3.7)
   (recommend Anaconda)

2. Install TelloPy

How to install

You can install stable version from PyPI.

```
$ pip install tellopy
```

Or install from the source code.

```
$ git clone https://github.com/hanyazou/TelloPy
$ cd TelloPy
$ python setup.py bdist_wheel
$ pip install dist/tellopy-*.dev*.whl --upgrade
```

3.write your first python script for tello!

https://github.com/hanyazou/TelloPy

DJI Tello:
First Programming

```
import tellopy #導入套件tellopy
from time import sleep

help(tellopy) #觀看套件的詳細說明

drone = tellopy.Tello() #建立物件tellopy.Tello()

drone.connect() #使程式與tello建立連接
drone.wait_fot_connection(s) #等待連接的時間, 秒數

drone.takeoff() #使tello起飛
sleep(3) #等待3秒(假如在wifi強度差的地方，請延長)

drone.land() #使tello降落
sleep(3)

drone.quit() #結束程式與tello的連接
```

DJI Tello:
First Programming

move:
- drone.up(val)
- drone.down(val)
- drone.set_throttle(thr_val): -1~1(neg: down, pos: up)

- drone.forward(val)
- drone.backward(val)
- drone.set_pitch(pit_val): -1~1(neg: back, pos: for)

- drone.right(val)
- drone.left(val)
- drone.set_roll(rol_val): -1~1(neg: left, pos: right)

rotate:
- drone.clockwise(val)
- drone.counter_clockwise(val)
- drone.set_yaw(yaw_val): -1~1(neg: left, pos: right)

val range: 0~100，此地方的值非速度或是距離，把她想像成傾斜程度

DJI Tello:
First Programming

Macro function:

flip:

```
drone.flip_forward()
drone.flip_back()
drone.flip_right()
drone.flip_left()
drone.flip_forwardleft()
drone.flip_backleft()
drone.flip_forwardright()
drone.flip_backright()
```

land:

```
drone.palm_land() #手掌降落
```

take pictures: (need EVENT_FILE_RECEIVED!)

```
drone.take_picture()
```

DJI Tello:
First Programming

move script:

```
def fly_poly(drone, sides):
  for s in range(sides):
    drone.forward(7)
    sleep(2)
    drone.clockwise(26)
    sleep(2)
    drone.take_picture()

fly_poly(2)
```

DJI Tello:
First Programming

EVENT:
EVENT_FLIGHT_DATA
EVENT_FILE_RECEIVED
...

How to use?

```
drone.subscribe(EVENT, handler)

def handler(event, sender, data):
  drone = sender
  if event is drone.EVENT_FLIGHT_DATA:
    print(data)
```

ALT: 0 | SPD: 0 | BAT: 9 | WIFI: 90 | CAM: 0 | MODE: 6

DJI Tello:
First Programming

```
def handleFileReceived(event, sender, data):
  pic_name = './tello.jpeg'
  with open(pic_name , 'wb') as fd:
    fd.write(data)

drone.subscribe(drone.EVENT_FILE_RECEIVED,
handleFileReceived)

drone.take_picture()
```

Via Source

```
# Get PyAV from GitHub.
$ git clone git@github.com:mikeboers/PyAV.git
$ cd PyAV

# Prep a virtualenv.
$ source scripts/activate.sh

# Install basic requirements.
$ pip install -r tests/requirements.txt

# Optionally build FFmpeg.
$ ./scripts/build-deps

# Build PyAV.
$ make
# or
$ python setup.py build_ext --inplace
```

VIDEO:

Need install `av, opencv-python, image, cv2, numpy`

`Install av:`

`need FFMpeg dependencies(doc is not the latest, please using the latest FFMpeg)`

http://docs.mikeboers.com/pyav/develop/installation.html

`sudo ldconfig`

`then install av`

1. `sudo python -m pip install av`
2. `via source`

   `reference left pic, git clone this:`

   https://github.com/mikeboers/PyAV.git
3. `anaconda:`

   conda config --add channels conda-forge

   conda install av -c conda-forge

Install Others:

`pip install opencv-python`

`pip install image`

DJI Tello:
First Programming

```
# 完整版請參考
https://github.com/hanyazou/TelloPy/tree/develop-0.7.0/tellopy/examples
import av
import numpy
import cv2

...
container = None
while container is None and 0 < retry:
  retry -= 1
  try:
    container = av.open(drone.get_video_stream())
  except av.AVError as ave:
    print(ave)
    print('retry...')
```

DJI Tello:
First Programming

```
        frame_skip = 300
        while True:
            for frame in container.decode(video=0):
                if 0 < frame_skip:
                    frame_skip = frame_skip - 1
                    continue
                start_time = time.time()
                image = cv2.cvtColor(numpy.array(frame.to_image()),
cv2.COLOR_RGB2BGR)
                cv2.imshow('Original', image)
                cv2.imshow('Canny', cv2.Canny(image, 100, 200))
                cv2.waitKey(1)
                if frame.time_base < 1.0/60:
                    time_base = 1.0/60
                else:
                    time_base = frame.time_base
                frame_skip = int((time.time() - start_time)/time_base)
```

DJI Tello:
First Programming