Tello Drone Exploration Lab

1 Overview

The goal of this lab is to become familiar with the drone controls, its network settings, and the ports it uses to send and receive information. This lab will introduce the DJITelloPy Python library as a method of controlling the drone.

2 Environment Setup

Install the Tello and X-Hubsan apps on your mobile device and DJITelloPy Python library on your computer. The DJITelloPy library is an open-source project and can be found here: https://github.com/damiafuentes/DJITelloPy.

You can install it from source or use the command

```
pip install djitellopy
```

Our testing found that installing the library using pip was easily done on **Ubuntu 20.04**, but prerequisite issues occurred when attempting to install it on Ubuntu 16.04.

So you need to:

- Install Tello and X-Hubsan app (you can also use Bluestacks android emulator https://bluestacks.com)
- Install DJITelloPy Python library

3 Drone Network Exploration

3.1 Network Access Settings

Connect to the drone using your Ubuntu 20.04 VM and run Wireshark to capture the traffic. You can use the sample code on GitHub: https://github.com/damiafuentes/DJITelloPy/blob/master/examples/simple.py.

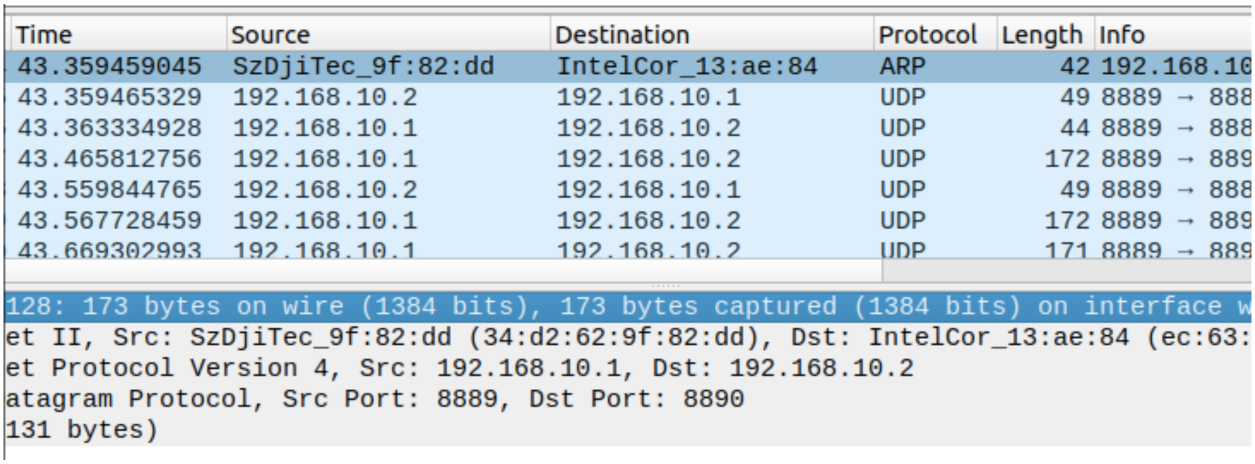
Q 3.1.1 [2.5 pts] What is the IP address of the drone?

192.168.10.1

Q 3.1.2 [2.5 pts] What is the IP address of your connecting device?

192.168.10.2

Include a screenshot from your computer or mobile device's network settings.



Time	Source	Destination	Protocol	Length	Info
43.359459045	SzDjiTec_9f:82:dd	IntelCor_13:ae:84	ARP	42	192.168.10
43.359465329	192.168.10.2	192.168.10.1	UDP	49	8889 → 888
43.363334928	192.168.10.1	192.168.10.2	UDP	44	8889 → 888
43.465812756	192.168.10.1	192.168.10.2	UDP	172	8889 → 889
43.559844765	192.168.10.2	192.168.10.1	UDP	49	8889 → 888
43.567728459	192.168.10.1	192.168.10.2	UDP	172	8889 → 889
43.669302993	192.168.10.1	192.168.10.2	UDP	171	8889 → 889

```
128: 173 bytes on wire (1384 bits), 173 bytes captured (1384 bits) on interface w
et II, Src: SzDjiTec_9f:82:dd (34:d2:62:9f:82:dd), Dst: IntelCor_13:ae:84 (ec:63:
et Protocol Version 4, Src: 192.168.10.1, Dst: 192.168.10.2
atagram Protocol, Src Port: 8889, Dst Port: 8890
131 bytes)
```

Q 3.1.3 [5 pts] What wireless security protocol is in use?

UDP

- **Q 3.1.4 [5 pts]** On the controller, which port is used to send commands to the drone?
- **8889**
- **Q 3.1.5 [5 pts]** On the drone, which port receives commands from the controller?
- **8890**

3.2 Important Ports

For this next step, you will need to control the drone while sniffing network traffic. The best way to do this is to run Wireshark on the device acting as the drone's controller. Connect to the drone on your computer and use the DJITelloPy library to create a controller for the drone on your computer. You can use the sample code on GitHub as a template in designing your drone controller: https://github.com/damiafuentes/DJITelloPy/blob/master/examples/manual-control-opencv.py.

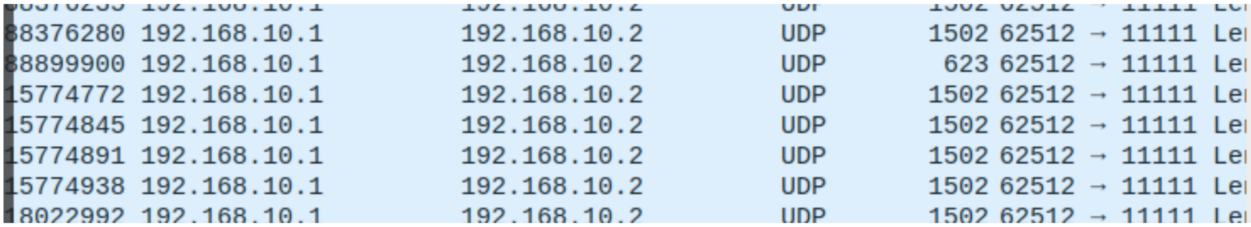
Run the code while sniffing traffic and give the drone a few commands. View the packet capture and answer the following questions:

- **Q 3.2.1a [5 pts]** On the controller, which port is used to send commands to the drone?

  62512

- **Q 3.2.1b [5 pts]** On the drone, which port receives commands from the controller?

  11111



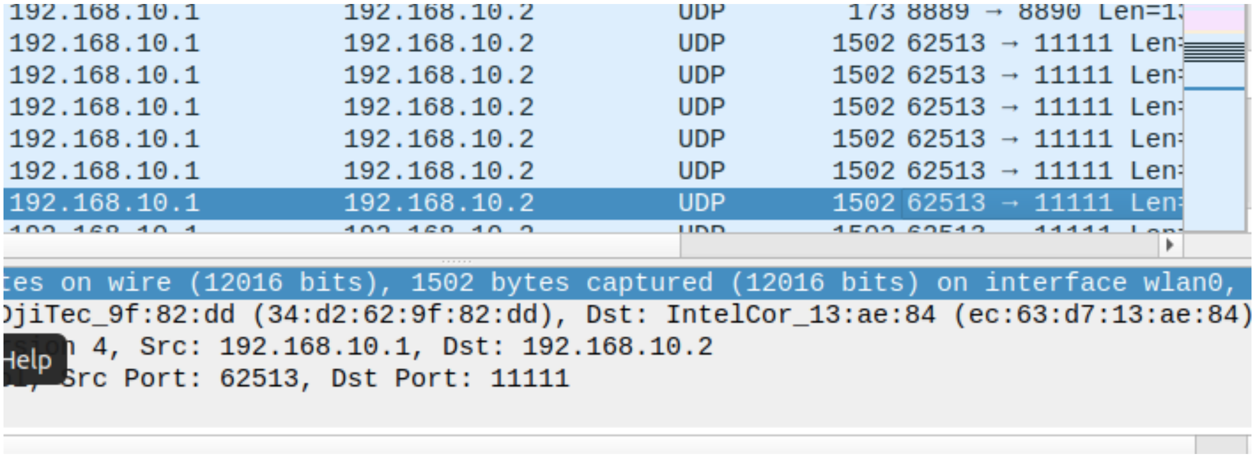
```
8376280 192.168.10.1     192.168.10.2     UDP     1502 62512 → 11111 Le
8899900 192.168.10.1     192.168.10.2     UDP      623 62512 → 11111 Le
5774772 192.168.10.1     192.168.10.2     UDP     1502 62512 → 11111 Le
5774845 192.168.10.1     192.168.10.2     UDP     1502 62512 → 11111 Le
5774891 192.168.10.1     192.168.10.2     UDP     1502 62512 → 11111 Le
5774938 192.168.10.1     192.168.10.2     UDP     1502 62512 → 11111 Le
8022992 192.168.10.1     192.168.10.2     UDP     1502 62512 → 11111 Le
```

- **Q 3.2.2a [5 pts]** On the drone, which port is used to send video feed to the controller?

  62513

- **Q 3.2.2b [5 pts]** On the controller, which port receives video feed?

  11111



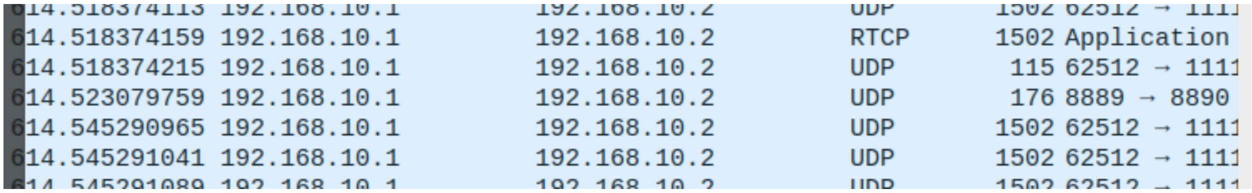
```
192.168.10.1     192.168.10.2     UDP      173 8889 → 8890 Len=1
192.168.10.1     192.168.10.2     UDP     1502 62513 → 11111 Len
192.168.10.1     192.168.10.2     UDP     1502 62513 → 11111 Len
192.168.10.1     192.168.10.2     UDP     1502 62513 → 11111 Len
192.168.10.1     192.168.10.2     UDP     1502 62513 → 11111 Len
192.168.10.1     192.168.10.2     UDP     1502 62513 → 11111 Len
192.168.10.1     192.168.10.2     UDP     1502 62513 → 11111 Len

es on wire (12016 bits), 1502 bytes captured (12016 bits) on interface wlan0,
jiTec_9f:82:dd (34:d2:62:9f:82:dd), Dst: IntelCor_13:ae:84 (ec:63:d7:13:ae:84)
n 4, Src: 192.168.10.1, Dst: 192.168.10.2
 Src Port: 62513, Dst Port: 11111
```

- **Q 3.2.3a [5 pts]** On the drone, which port sends directional status messages to the controller?

  8889

- **Q 3.2.3b [5 pts]** On the controller, which port receives the status updates from the drone?

  8890



```
14.518374159 192.168.10.1     192.168.10.2     RTCP    1502 Application
14.518374215 192.168.10.1     192.168.10.2     UDP      115 62512 → 1111
14.523079759 192.168.10.1     192.168.10.2     UDP      176 8889 → 8890
14.545290965 192.168.10.1     192.168.10.2     UDP     1502 62512 → 1111
14.545291041 192.168.10.1     192.168.10.2     UDP     1502 62512 → 1111
```

Include screenshots of Wireshark packets for each pair of these questions.

4 Drone Photo and Video Feed

4.1 Storage

Take a photo using this code:

https://github.com/damiafuentes/DJITelloPy/blob/master/examples/take-picture.py

Q 4.1 [5 pts] Was the photo that was taken stored on the drone or only on the VM? which port is used to send that photo to the controller?

It was stored on the VM. Port **62513**

4.2 Data Streams

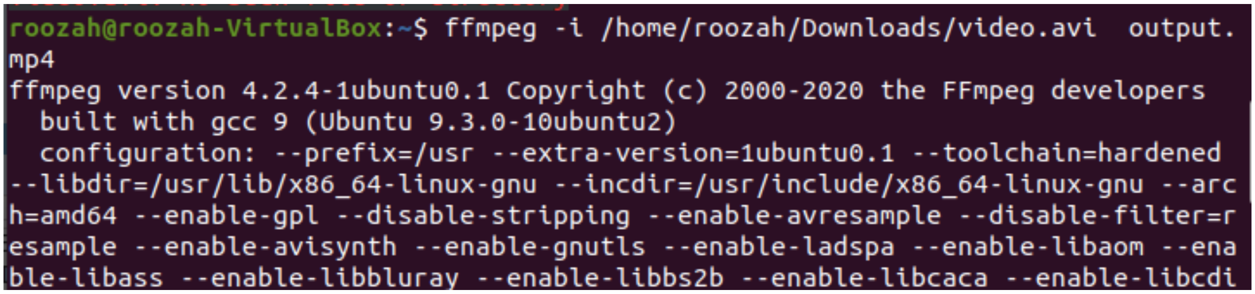
Connect to the drone on your computer. Using the DJITelloPy library, fly the drone and capture video from your computer using this code:

https://github.com/damiafuentes/DJITelloPy/blob/master/examples/record-video.py

While you fly the drone, capture the raw data of the video stream using Wireshark. In Wireshark, this can be done by right clicking on a packet that is part of the stream and clicking Follow > UDP Stream. A window with the data stream should pop up. Change the "Show data as" field to "Raw" and click "Save As."

Q 4.2.1 [10 pts] What file format are videos saved in and what is the video codec of the stream? Convert the video stream to a format that your device can easily view. (Please do this with a command line tool rather than sketchy online services). Include a screenshot of the command used.

It's saved in .Avi format. The video codec is MPEG-4 Video. It was already converted by my lab partner.



```
roozah@roozah-VirtualBox:~$ ffmpeg -i /home/roozah/Downloads/video.avi  output.
mp4
ffmpeg version 4.2.4-1ubuntu0.1 Copyright (c) 2000-2020 the FFmpeg developers
  built with gcc 9 (Ubuntu 9.3.0-10ubuntu2)
  configuration: --prefix=/usr --extra-version=1ubuntu0.1 --toolchain=hardened
--libdir=/usr/lib/x86_64-linux-gnu --incdir=/usr/include/x86_64-linux-gnu --arc
h=amd64 --enable-gpl --disable-stripping --enable-avresample --disable-filter=r
esample --enable-avisynth --enable-gnutls --enable-ladspa --enable-libaom --ena
ble-libass --enable-libbluray --enable-libbs2b --enable-libcaca --enable-libcdi
```

Q 4.2.2 [10 pts] Attach a segment of this video (no longer than 15 seconds please) from the drone in your submission on Blackboard.

4.3 Capture the Flag

Download this pcap of drone traffic and extract the video from it.

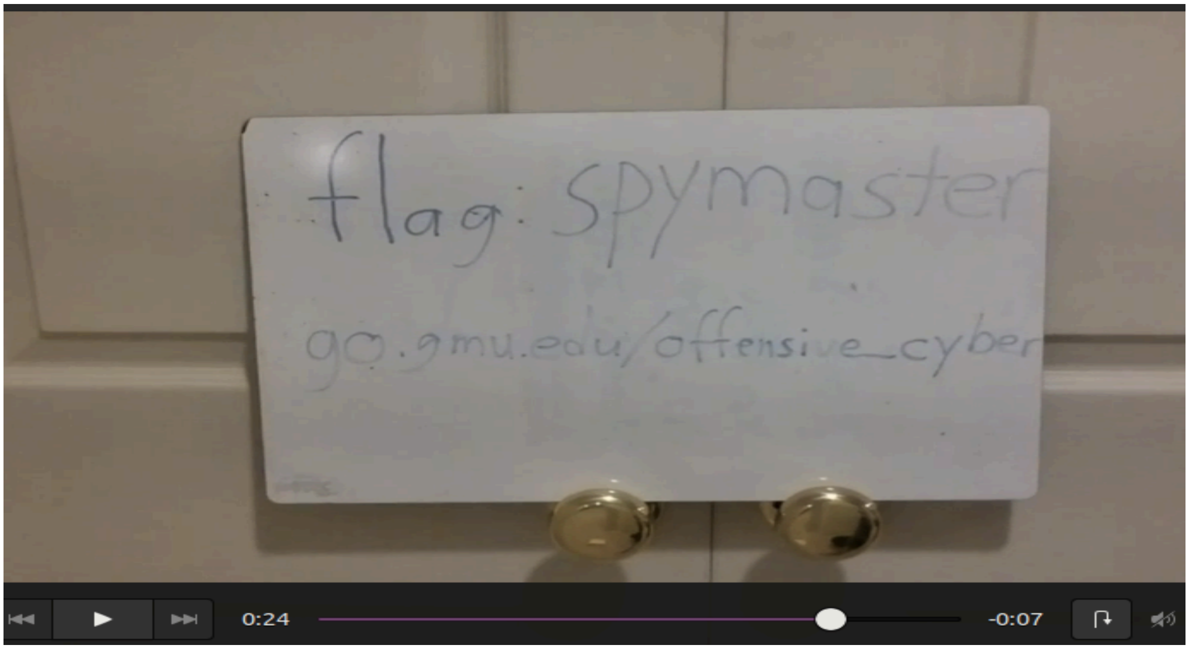
Q 4.3 [20 pts] What is the flag shown in the video? Show screenshots and explain your steps.

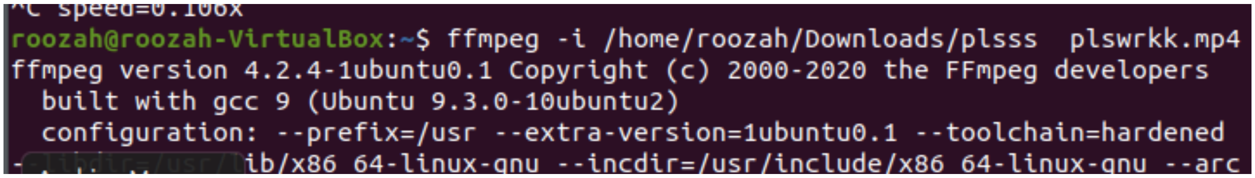
Link to download:

https://drive.google.com/file/d/1AAOKCqye6pSNtEq5NHbhpX--r1R-6qFQ/view?usp=sharing

flag: Spymaster

go.gmu.edu/offensive_cyebr





```
^C speed=0.106x
roozah@roozah-VirtualBox:~$ ffmpeg -i /home/roozah/Downloads/plsss  plswrkk.mp4
ffmpeg version 4.2.4-1ubuntu0.1 Copyright (c) 2000-2020 the FFmpeg developers
  built with gcc 9 (Ubuntu 9.3.0-10ubuntu2)
  configuration: --prefix=/usr --extra-version=1ubuntu0.1 --toolchain=hardened
--libdir=/usr/lib/x86_64-linux-gnu --incdir=/usr/include/x86_64-linux-gnu --arc
```

I chose a random packet from the ctf pcap file and right click follow>UDP stream> show data as RAW and then I used the command in the terminal to convert to video.

5 Drone Commands

View the data stream containing the command and control traffic sent to and from the drone. Include a screenshot of the data stream.

Q 5.1 [5 pts] What keyword initiates the control mode?

Command

Q 5.2 [5 pts] What two possible responses can the drone reply with when receiving a command?

Ok and error