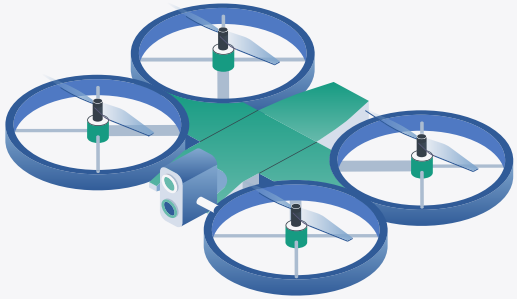
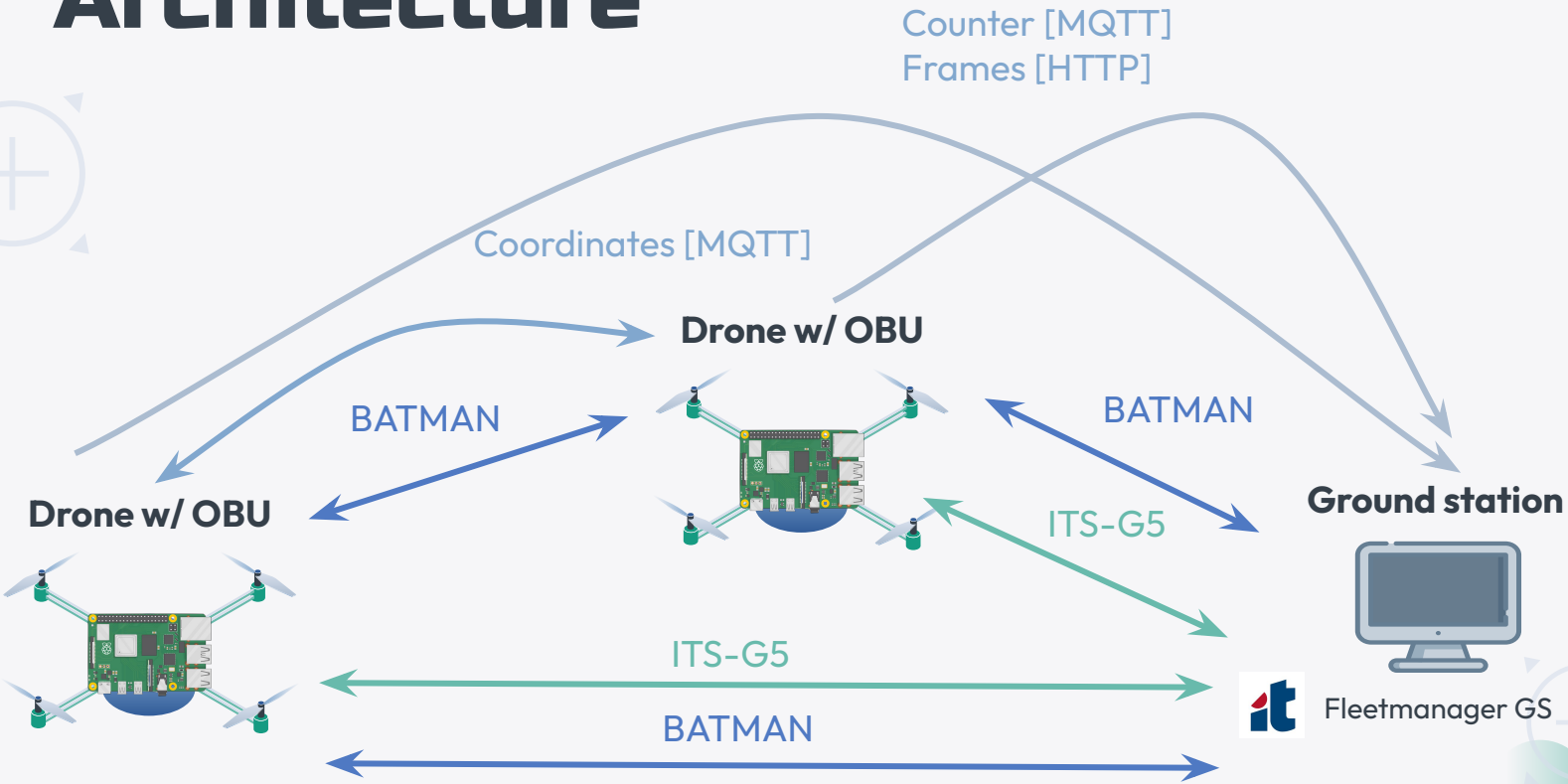


Redes e Sistemas Autónomos 2023/24

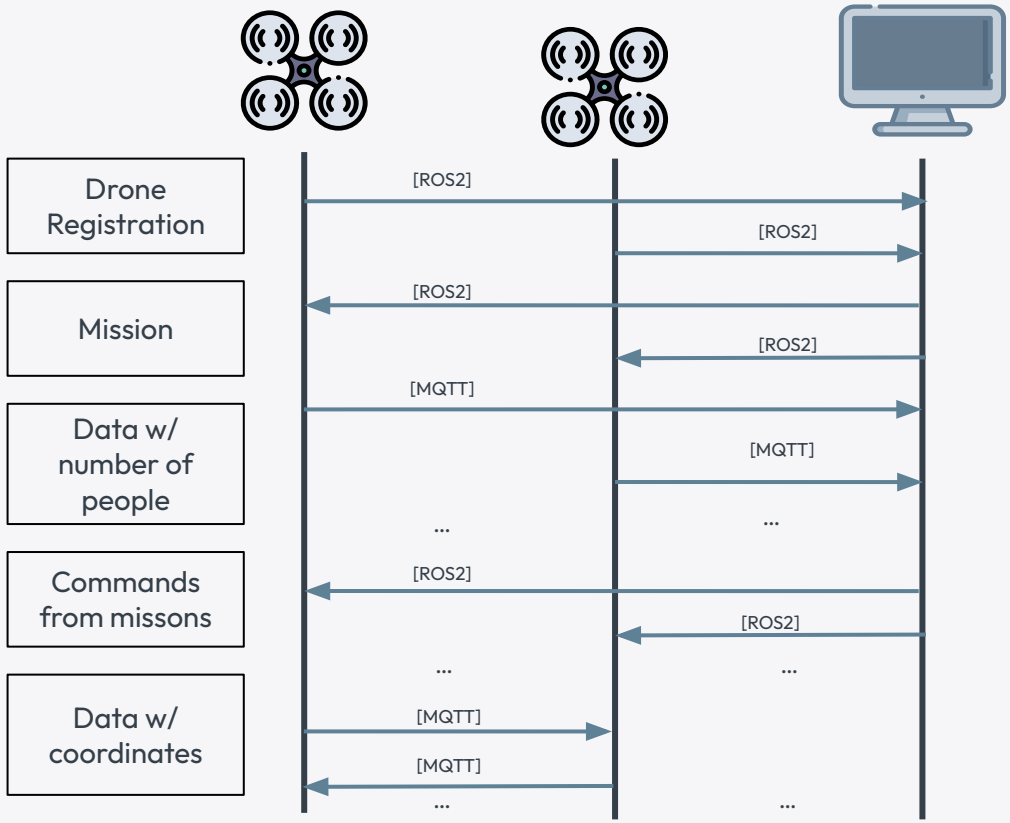
DRONE MESH FOR CROWD DENSITY MONITORING

Diogo Correia 90327
Tiago Rodrigues 93413

Architecture



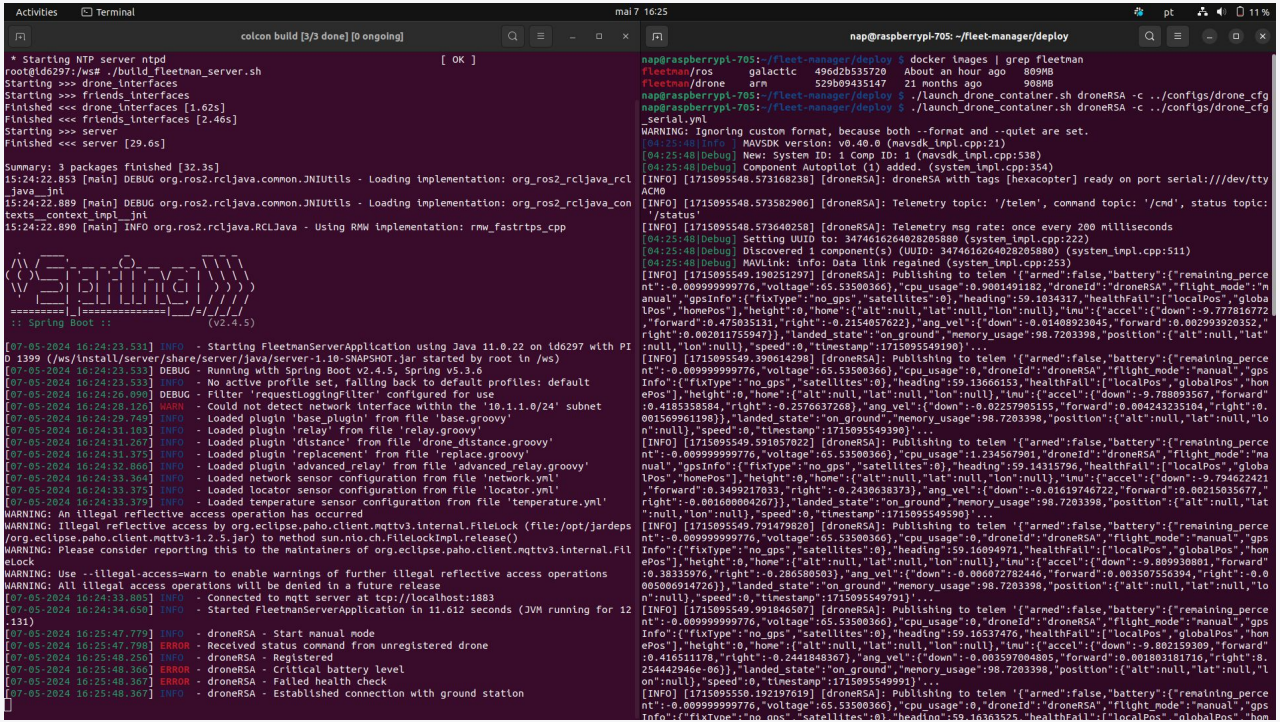
Event sequence



What was done on the 1st iteration

- Person detection algorithm implementation using ultralytics, an efficient way of implementing YOLO.
- Drones connection to Fleetmanager Ground station (NAP@IT-Aveiro)

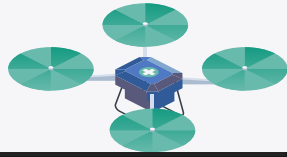
Drone Connection



Person detection

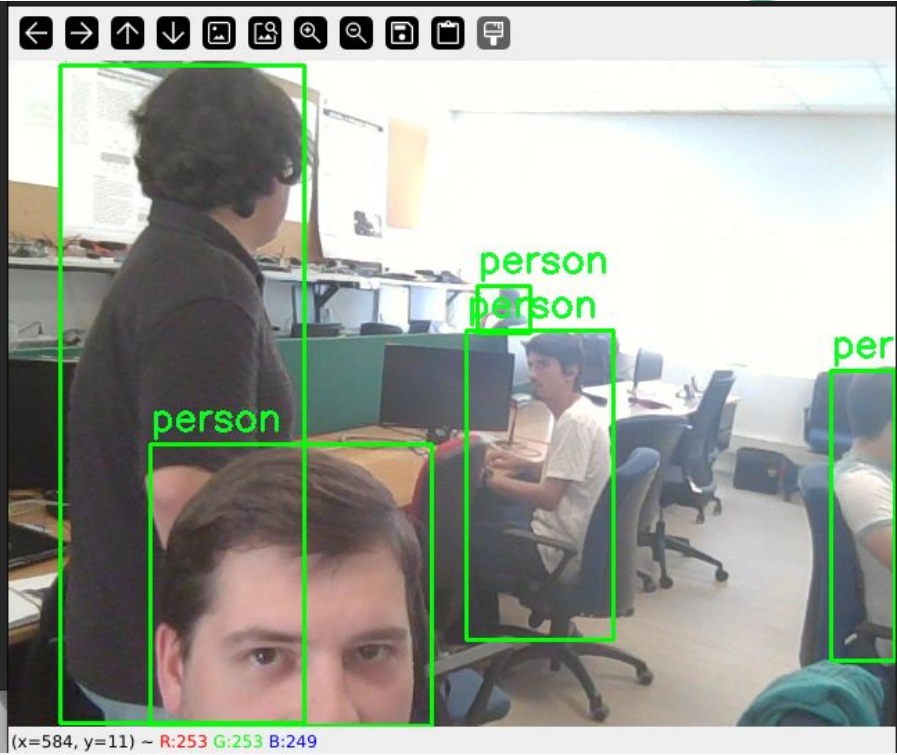
Output examples

Test using Demo Picutre



personal@id6297: ~/Desktop/RSA/project

```
People detected: 5
People detected: 7
People detected: 4
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 5
People detected: 4
People detected: 4
People detected: 4
People detected: 5
People detected: 5
People detected: 4
People detected: 5
People detected: 5
People detected: 5
People detected: 5
```

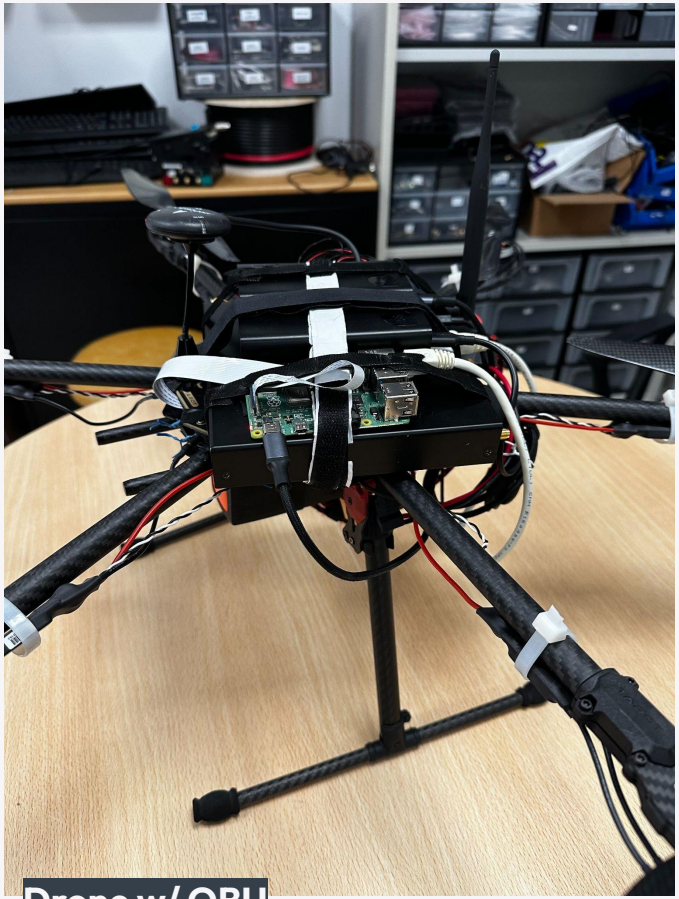


Test using Webcam streaming

What we have (and don’t) so far

Components

Ground station



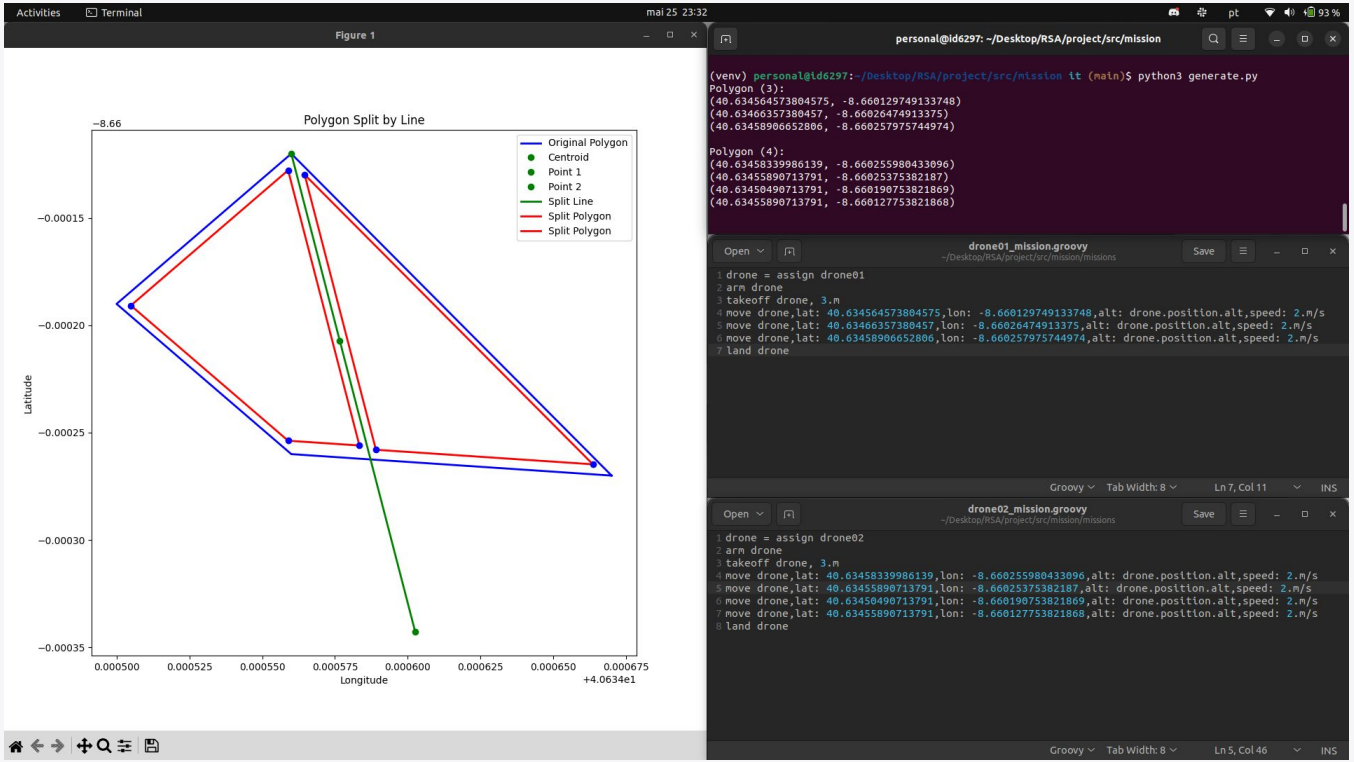
Drone w/ OBU

Ground station

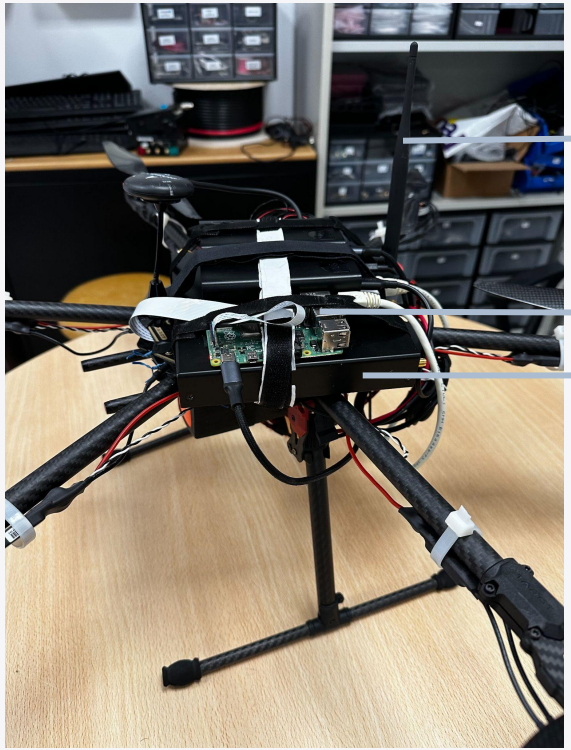
The Ground station has:

- A WLAN interface with **ITS-G5**, used to communicate with the drones and **send commands**.
- A WLAN interface with **Wi-Fi**, used to integrate a **BATMAN** ad-hoc network and **receive the video frames** from each drone
- A CPU running the **Fleetmanager Groundstation** module, and this project's **Dashboard** with the video streaming, the person counter and the mission generator.

Mission Generator



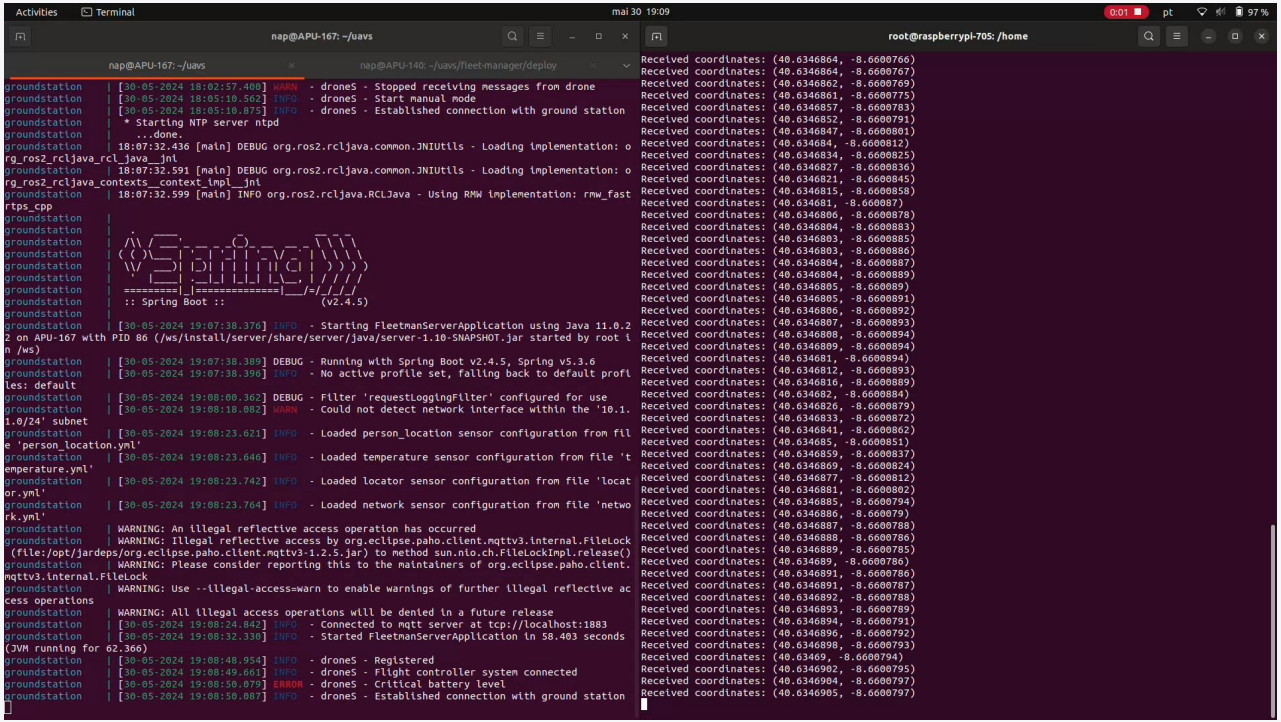
Drone



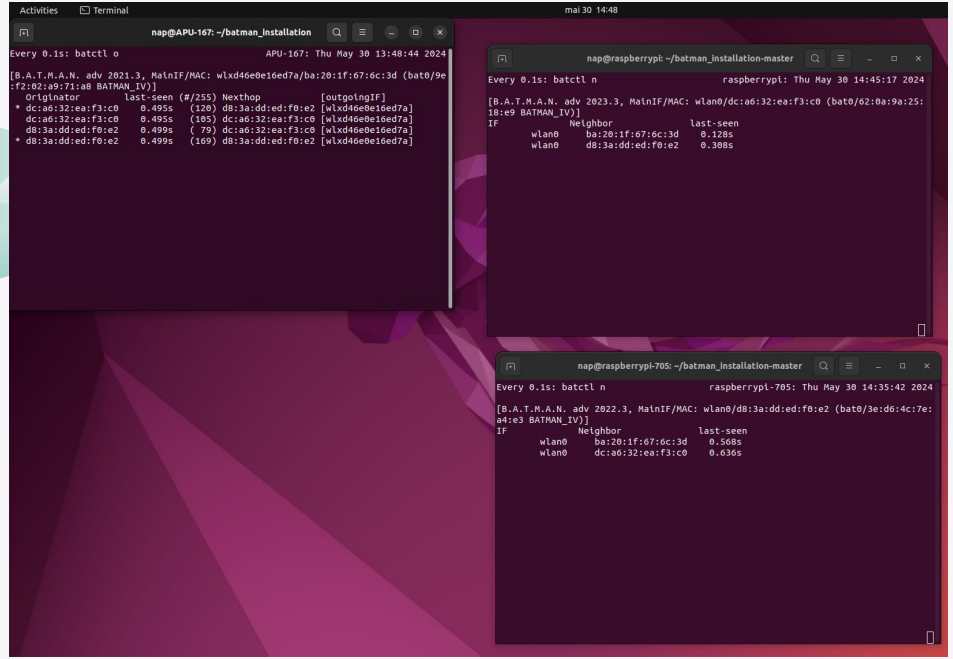
The drone has:

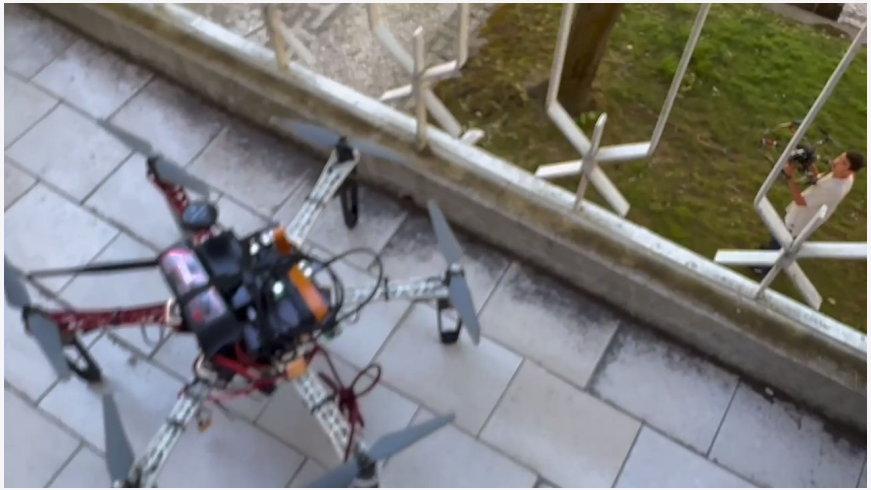
- A WLAN interface with **ITS-G5**, used to communicate with the ground station and **receive commands**.
- A WLAN interface with **Wi-Fi** on the Raspberry Pi, used to integrate a **BATMAN** ad-hoc network and **send the video frames** through HTTP and the **Counter** and **Coordinates** through MQTT
- A CPU running the **Fleetmanager Drone** module and a Raspberry Pi running the **Detection** module and the **Telemetry** module

Telemetry

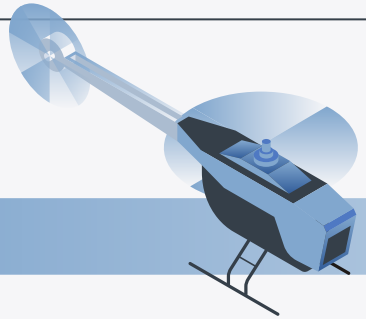

Activities
Terminal
mai 30 19:09
nap@APU-167: ~/uavs
root@raspberrypi-705: /home
nap@APU-167: ~/uavs
nap@APU-140: ~/uavs/fleet-manager/deploy
groundstation | [30-05-2024 18:02:57.400] WARN - droneS - Stopped receiving messages from drone
groundstation | [30-05-2024 18:05:10.562] INFO - droneS - Start manual mode
groundstation | [30-05-2024 18:05:10.875] INFO - droneS - Established connection with ground station
groundstation | * Starting NTP server ntpd
groundstation | ...done.
groundstation | 18:07:32.436 [main] DEBUG org.ros2.rcljava.common.JNIUtils - Loading implementation: org_ros2_rcljava_rcl_java__jni
groundstation | 18:07:32.591 [main] DEBUG org.ros2.rcljava.common.JNIUtils - Loading implementation: org_ros2_rcljava_contexts__context_impl__jni
groundstation | 18:07:32.599 [main] INFO org.ros2.rcljava.RCLJava - Using RMW implementation: rmw_fastrtps_cpp
groundstation | :: Spring Boot :: (v2.4.5)
groundstation | [30-05-2024 19:07:38.376] INFO - droneS - Starting FleetmanServerApplication using Java 11.0.22 on APU-167 with PID 86 (/ws/install/server/share/server/java/server-1.10-SNAPSHOT.jar started by root in /ws)
groundstation | [30-05-2024 19:07:38.389] DEBUG - droneS - Running with Spring Boot v2.4.5, Spring v5.3.6
groundstation | [30-05-2024 19:07:38.396] INFO - droneS - No active profile set, falling back to default profiles: default
groundstation | [30-05-2024 19:08:00.362] DEBUG - droneS - Filter 'requestLoggingFilter' configured for use
groundstation | [30-05-2024 19:08:18.082] WARN - droneS - Could not detect network interface within the '10.1.1.0/24' subnet
groundstation | [30-05-2024 19:08:23.621] INFO - droneS - Loaded person_location sensor configuration from file 'person_location.yml'
groundstation | [30-05-2024 19:08:23.646] INFO - droneS - Loaded temperature sensor configuration from file 'temperature.yml'
groundstation | [30-05-2024 19:08:23.742] INFO - droneS - Loaded locator sensor configuration from file 'locator.yml'
groundstation | [30-05-2024 19:08:23.764] INFO - droneS - Loaded network sensor configuration from file 'network.yml'
groundstation | WARNING: An illegal reflective access operation has occurred
groundstation | WARNING: Illegal reflective access by org.eclipse.paho.client.mqttv3.internal.FileLock (file:/opt/jardeps/org.eclipse.paho.client.mqttv3-1.2.5.jar) to method sun.nio.ch.FileLockImpl.release()
groundstation | WARNING: Please consider reporting this to the maintainers of org.eclipse.paho.client.mqttv3.internal.FileLock
groundstation | WARNING: Use --illegal-access=warn to enable warnings of further illegal reflective access operations
groundstation | WARNING: All illegal access operations will be denied in a future release
groundstation | [30-05-2024 19:08:24.842] INFO - droneS - Connected to mqtt server at tcp://localhost:1883
groundstation | [30-05-2024 19:08:32.330] INFO - droneS - Started FleetmanServerApplication in 58.403 seconds (JVM running for 62.366)
groundstation | [30-05-2024 19:08:48.954] INFO - droneS - Registered
groundstation | [30-05-2024 19:08:49.661] INFO - droneS - Flight controller system connected
groundstation | [30-05-2024 19:08:50.079] ERROR - droneS - Critical battery level
groundstation | [30-05-2024 19:08:50.087] INFO - droneS - Established connection with ground station
Received coordinates: (40.6346864, -8.6600766)
Received coordinates: (40.6346864, -8.6600767)
Received coordinates: (40.6346862, -8.6600769)
Received coordinates: (40.6346861, -8.6600775)
Received coordinates: (40.6346857, -8.6600783)
Received coordinates: (40.6346852, -8.6600791)
Received coordinates: (40.6346847, -8.6600801)
Received coordinates: (40.634684, -8.6600812)
Received coordinates: (40.6346834, -8.6600825)
Received coordinates: (40.6346827, -8.6600836)
Received coordinates: (40.6346821, -8.6600845)
Received coordinates: (40.6346815, -8.6600858)
Received coordinates: (40.634681, -8.660087)
Received coordinates: (40.6346806, -8.6600878)
Received coordinates: (40.6346804, -8.6600883)
Received coordinates: (40.6346803, -8.6600885)
Received coordinates: (40.6346803, -8.6600886)
Received coordinates: (40.6346804, -8.6600887)
Received coordinates: (40.6346804, -8.6600889)
Received coordinates: (40.6346805, -8.660089)
Received coordinates: (40.6346805, -8.6600891)
Received coordinates: (40.6346806, -8.6600892)
Received coordinates: (40.6346807, -8.6600893)
Received coordinates: (40.6346808, -8.6600894)
Received coordinates: (40.6346809, -8.6600894)
Received coordinates: (40.634681, -8.6600894)
Received coordinates: (40.6346812, -8.6600893)
Received coordinates: (40.6346816, -8.6600889)
Received coordinates: (40.6346682, -8.6600884)
Received coordinates: (40.6346826, -8.6600879)
Received coordinates: (40.6346833, -8.6600872)
Received coordinates: (40.6346841, -8.6600862)
Received coordinates: (40.6346685, -8.6600851)
Received coordinates: (40.6346859, -8.6600837)
Received coordinates: (40.6346869, -8.6600824)
Received coordinates: (40.6346877, -8.6600812)
Received coordinates: (40.6346881, -8.6600802)
Received coordinates: (40.6346885, -8.6600794)
Received coordinates: (40.6346886, -8.660079)
Received coordinates: (40.6346887, -8.6600788)
Received coordinates: (40.6346888, -8.6600786)
Received coordinates: (40.6346889, -8.6600785)
Received coordinates: (40.634689, -8.6600786)
Received coordinates: (40.6346891, -8.6600786)
Received coordinates: (40.6346891, -8.6600787)
Received coordinates: (40.6346892, -8.6600788)
Received coordinates: (40.6346893, -8.6600789)
Received coordinates: (40.6346894, -8.6600791)
Received coordinates: (40.6346896, -8.6600792)
Received coordinates: (40.6346898, -8.6600793)
Received coordinates: (40.63469, -8.6600794)
Received coordinates: (40.6346902, -8.6600795)
Received coordinates: (40.6346904, -8.6600797)
Received coordinates: (40.6346905, -8.6600797)

B.A.T.M.A.N.


Activities
Terminal
mai 30 14:48
nap@APU-167: ~/batman_installation
Every 0.1s: batctl o
APU-167: Thu May 30 13:48:44 2024
[B.A.T.M.A.N. adv 2021.3, MainIF/MAC: wlxd46e0e16ed7a/ba:20:1f:67:6c:3d (bat0/9e:f2:02:a9:71:a8 BATMAN_IV)]
Originator last-seen (#/255) Nexthop [outgoingIF]
* dc:a6:32:ea:f3:c0 0.495s (120) d8:3a:dd:ed:f0:e2 [wlxd46e0e16ed7a]
dc:a6:32:ea:f3:c0 0.495s (105) dc:a6:32:ea:f3:c0 [wlxd46e0e16ed7a]
d8:3a:dd:ed:f0:e2 0.499s (79) dc:a6:32:ea:f3:c0 [wlxd46e0e16ed7a]
* d8:3a:dd:ed:f0:e2 0.499s (169) d8:3a:dd:ed:f0:e2 [wlxd46e0e16ed7a]
nap@raspberrypi: ~/batman_installation-master
Every 0.1s: batctl n
raspberrypi: Thu May 30 14:45:17 2024
[B.A.T.M.A.N. adv 2023.3, MainIF/MAC: wlan0/dc:a6:32:ea:f3:c0 (bat0/62:0a:9a:25:18:e9 BATMAN_IV)]
IF Neighbor last-seen
wlan0 ba:20:1f:67:6c:3d 0.128s
wlan0 d8:3a:dd:ed:f0:e2 0.308s
nap@raspberrypi-705: ~/batman_installation-master
Every 0.1s: batctl n
raspberrypi-705: Thu May 30 14:35:42 2024
[B.A.T.M.A.N. adv 2022.3, MainIF/MAC: wlan0/d8:3a:dd:ed:f0:e2 (bat0/3e:d6:4c:7e:a4:e3 BATMAN_IV)]
IF Neighbor last-seen
wlan0 ba:20:1f:67:6c:3d 0.568s
wlan0 dc:a6:32:ea:f3:c0 0.636s



What is missing



Questions