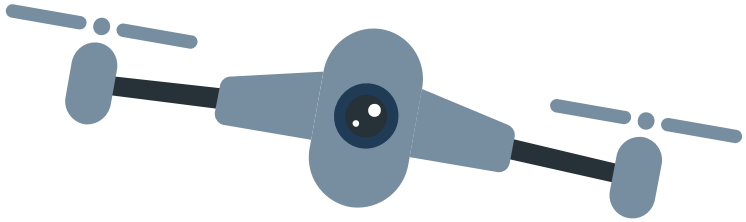
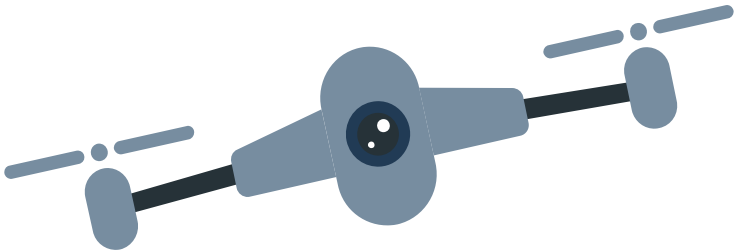
Drone Relay

Aerial Drone Platform with relays for scenarios of limitation and emergency





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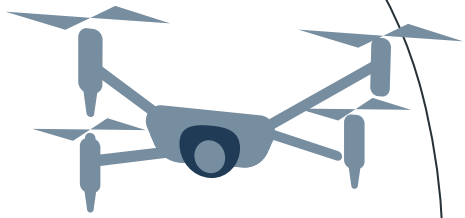
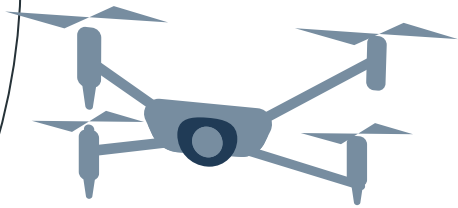
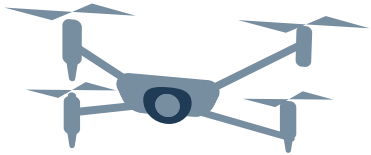
Context

- Many research projects have been developed due to the importance of UAVs in Surveillance and monitoring tasks.
- This project is going to be developed with the foundation of a mission planning project.

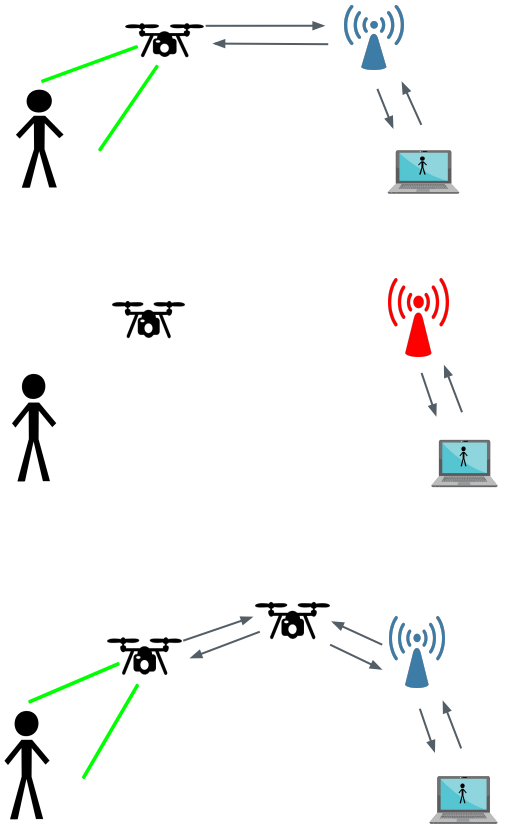






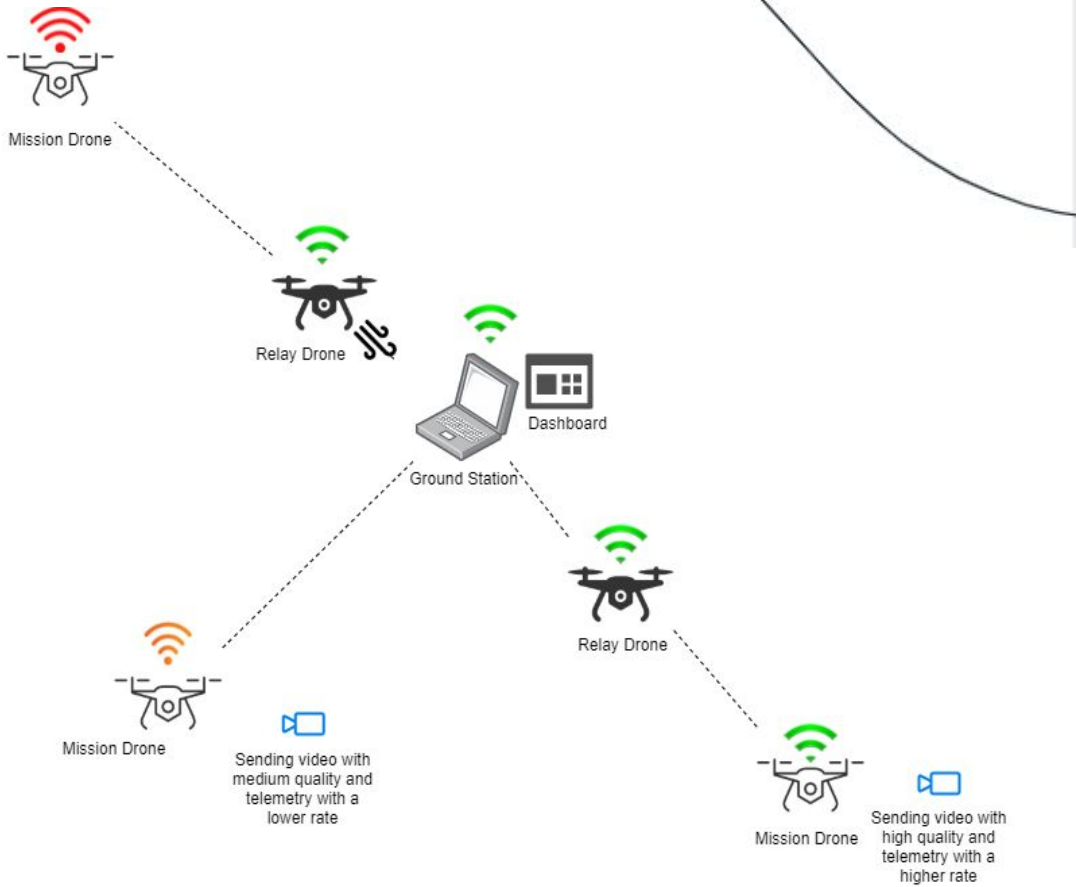
Goals

- Measure network quality between the nodes
- Relay drone adopts an optimal position to provide good network quality to the mission drones.This position is dynamically updated.
- Dynamically adapt telemetry frequency, transmission ratio and video quality according to the current communication quality.



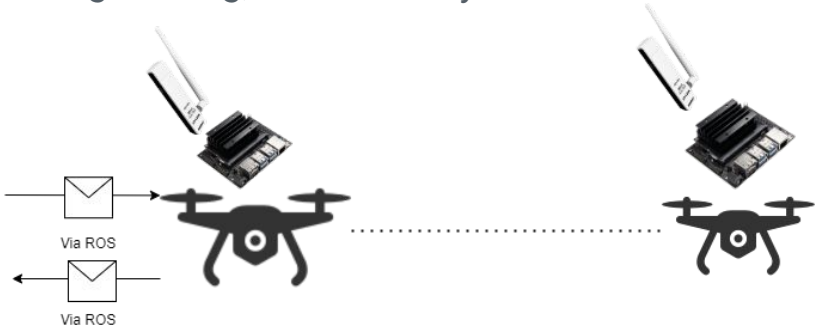
Overview

- Video Quality Codec Module
- Wireless Network Sensor
- Mission Algorithm
- Telemetry Module
- Backend and Dashboard

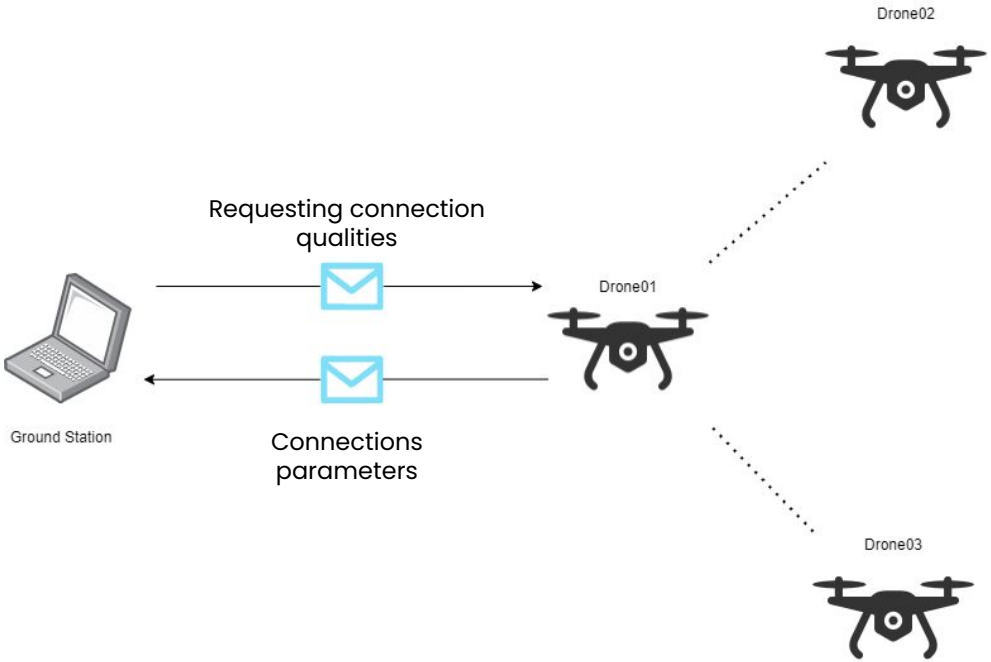


Wireless Network Sensor

- This module provides network quality parameters between specific nodes in the ad-hoc network.
- The Ground Station can make requests, via ROS, asking for the network quality between drones/Ground Station.
- The network sensor that receives this request, using tools such as IW and the ping tool, will retrieve the values such as the RSSI(Received Signal Strength Indicator), the Sending/Receiving Bit rate, the latency, make an estimate value of the network quality and forward the information via ROS.
- We also implemented metrics such as the interface current throughput using the sysstat tool and the number of collisions and errors using ifconfig, however they were not used on the field tests due time constraints.



Wireless Network Sensor



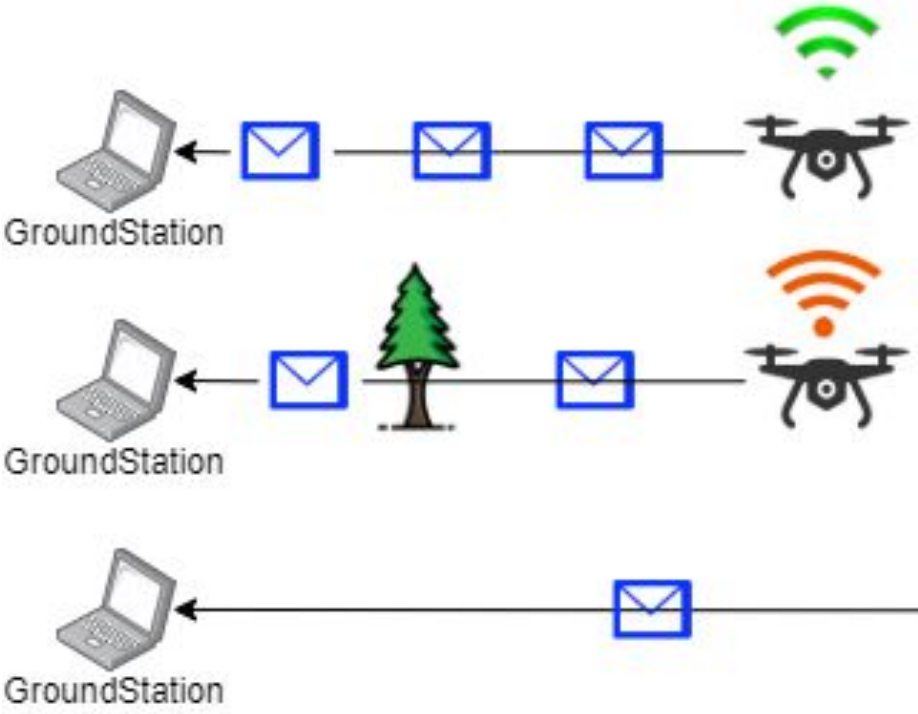
Example of a message with the network parameters between drone01 and drone02:

{Station: “04:05:06:07:08:01”
IP: “10.1.1.6”
Latency: “0.80ms”
Signal: “70.0”
TxByte: “12056”
RxBit: “48 Mbit/s”
TxBit: “48 Mbit/s”
Connection: “drone02”
NetworkQuality: “HIGH”}

Example of a message with the network parameters between drone01 and drone03:

{Station: “04:05:06:07:08:00”
IP: “10.1.1.5”
Latency: “0.72ms”
Signal: “63.0”
TxByte: “12000”
RxBit: “54 Mbit/s”
TxBit: “54 Mbit/s”
Connection: “drone03”
NetworkQuality: “HIGH”}

Telemetry module

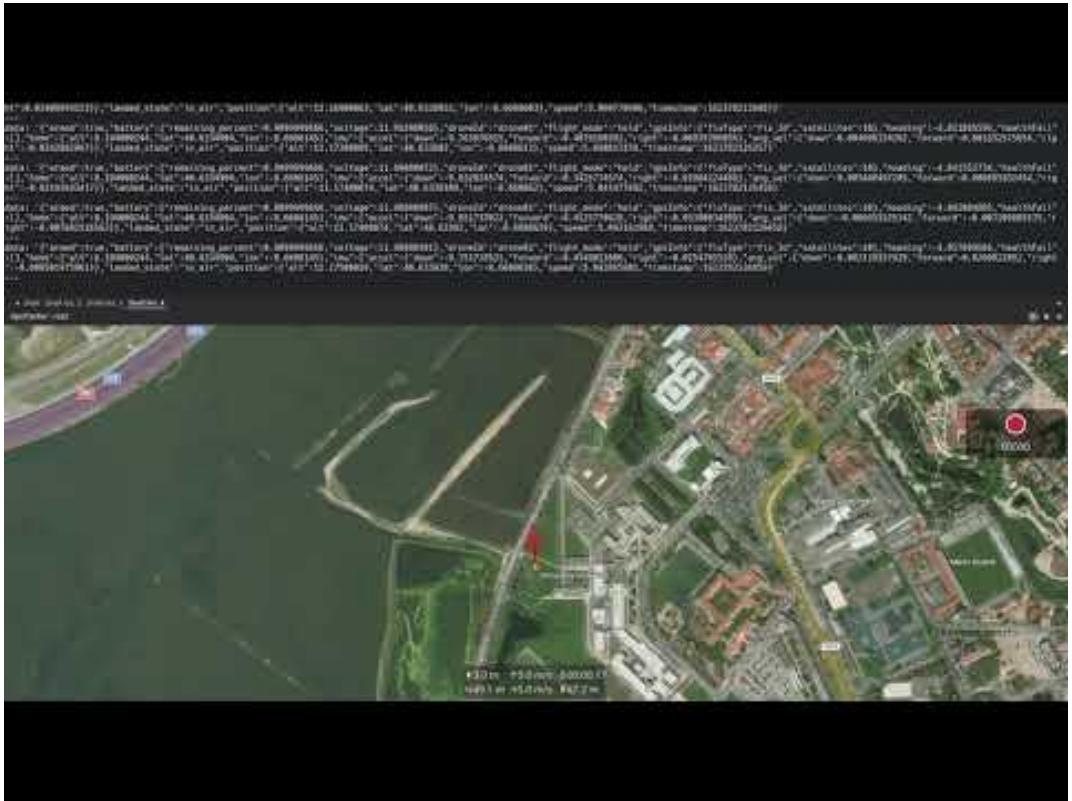


High transmission ratio

Medium transmission ratio

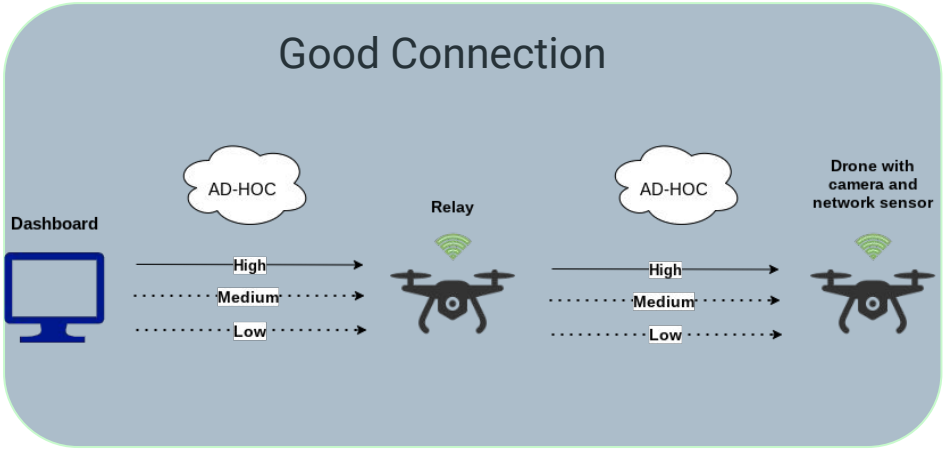
Low transmission ratio

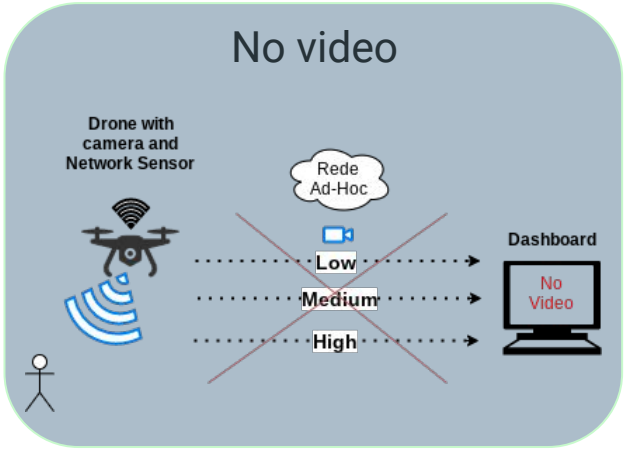
Video Demonstration



Video quality codec Module

This module is responsible for showing the video feed encoded from the drone automatically adapting quality with the network sensor.

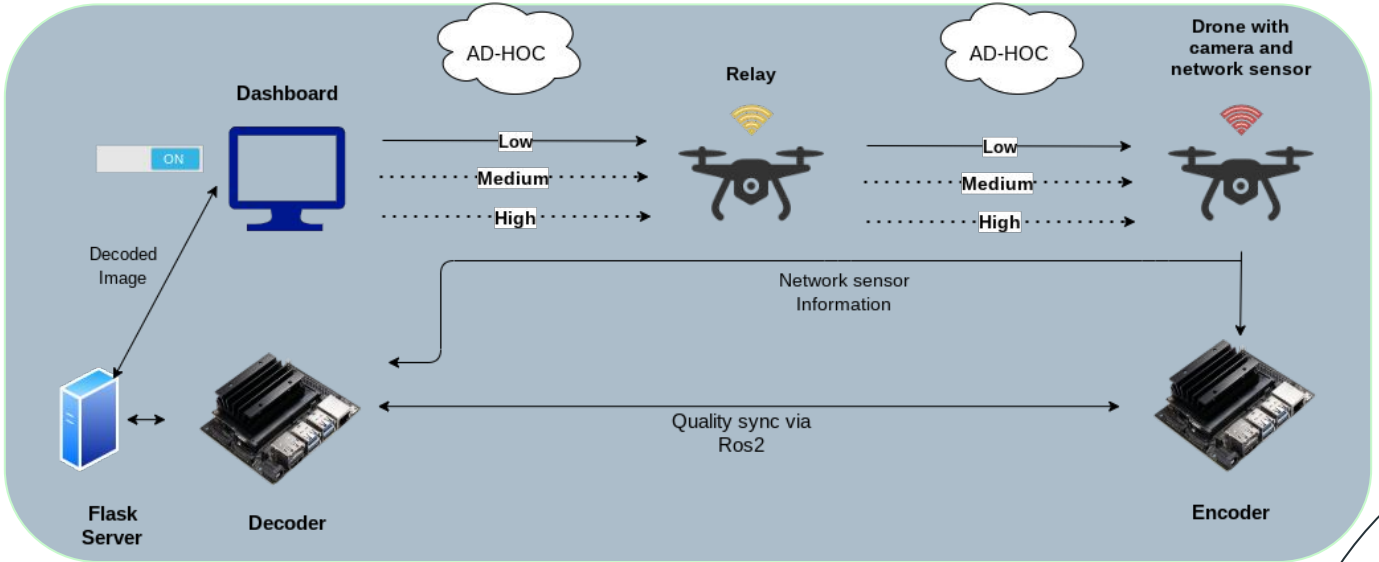




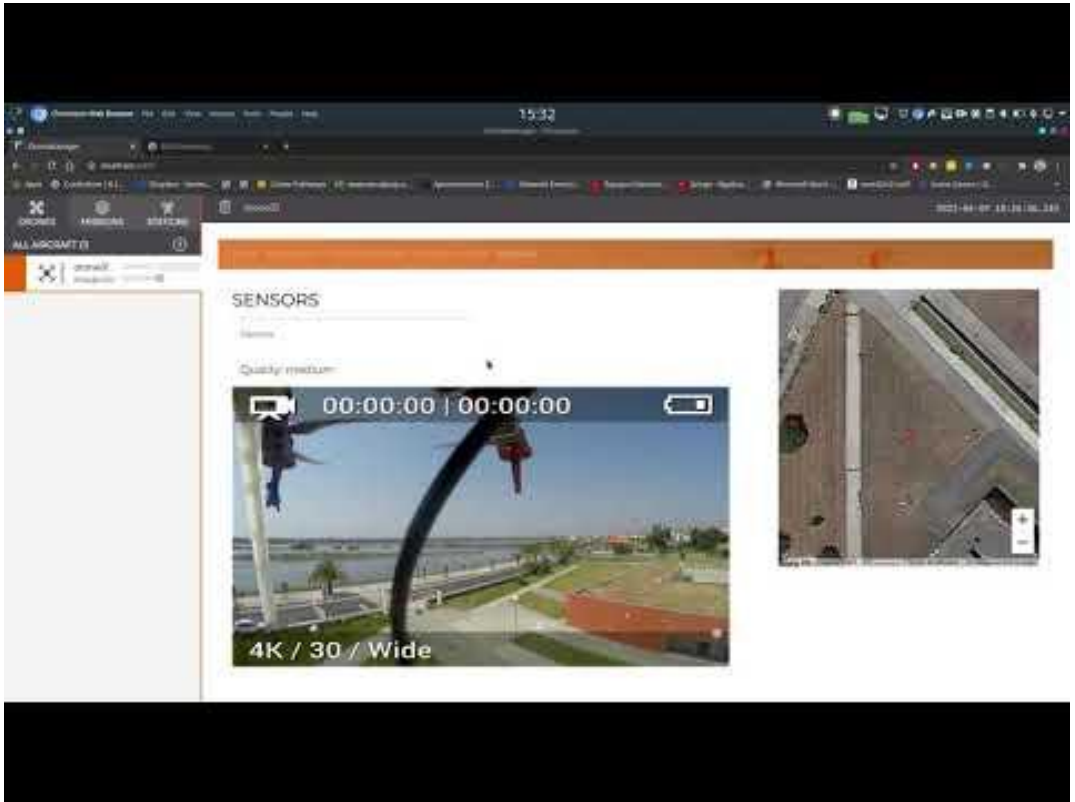
In-depth video quality codec Module

For the change and transmission of video to occur, the most important factors are:

- Sync between the encoder and decoder
- Video cutoff, as to not overload network
- Change the quality with the network sensor, that provides a parameter with the best quality available according to the network state.



Video Demonstration

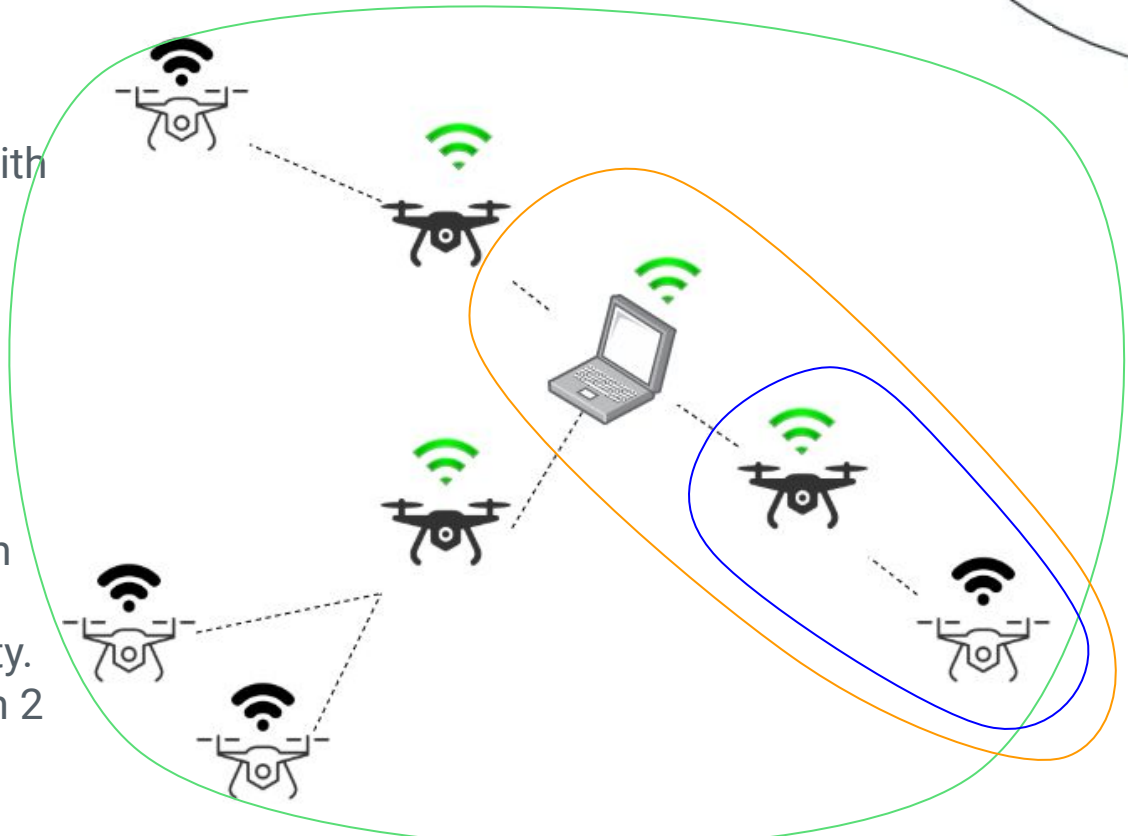


Mission Algorithm

Update drones position in order to provide the best possible network with the available drones.

Decomposed in 3 parts:

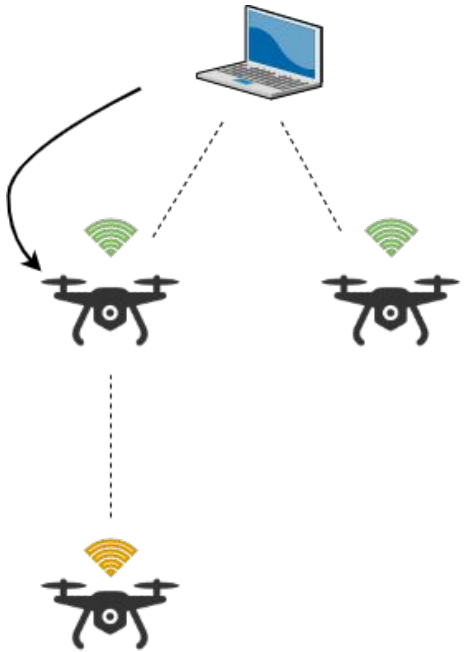
- **Network state:** Graph representing the network.
- **Drone Relay Bridge:** Connection between mission drone without connection to a connected entity.
- **Relay Link:** connection between 2 entities.



Mission Algorithm

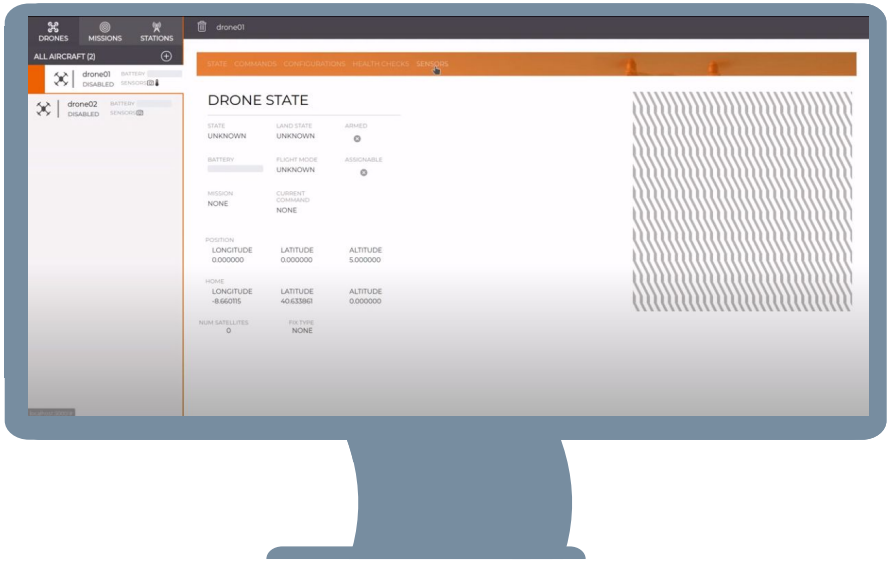
- The algorithm creates multiple trees, each tree starts with a connected entity (ground station or connected drone), then the tree grows with drones needing relay in order to maintain their connectivity.

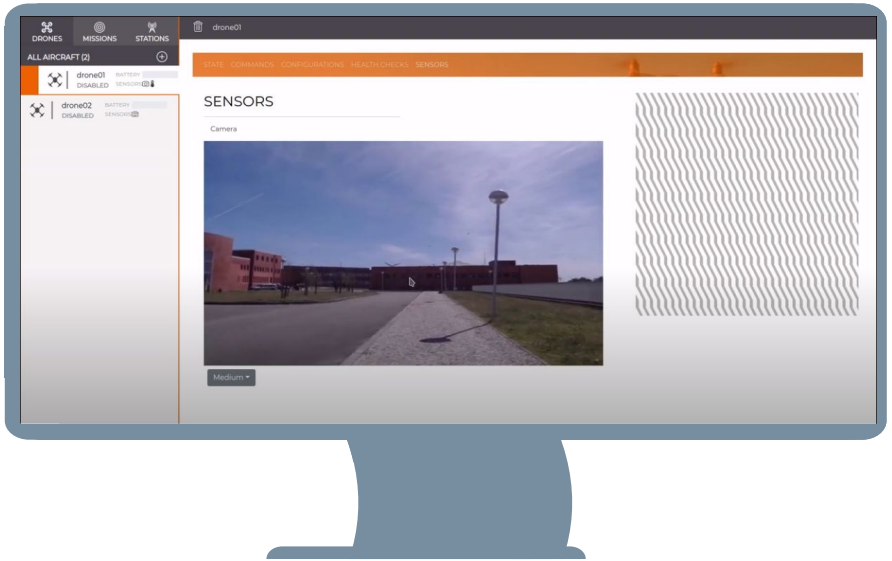
- Every time a drone is added to the tree, it is maintained until is no longer needed or is worth to switch that drone to another tree.

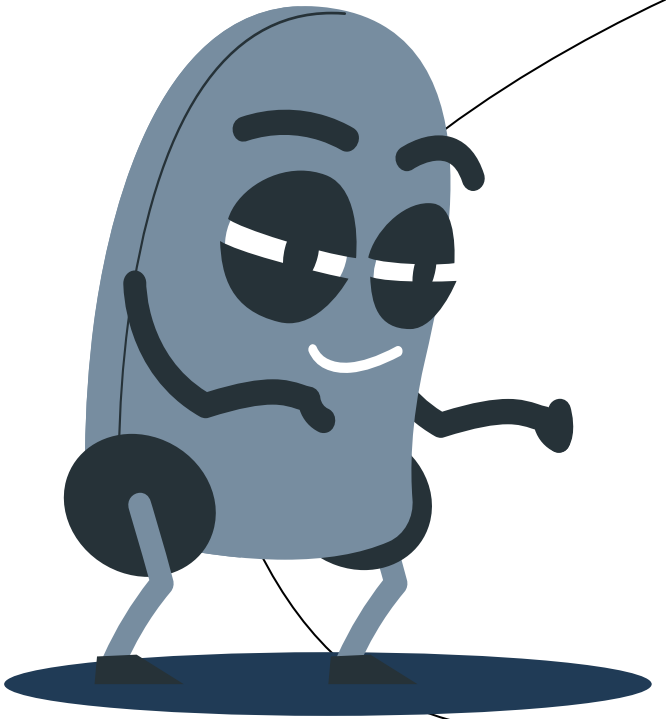


Video Demonstration

Backend and Dashboard

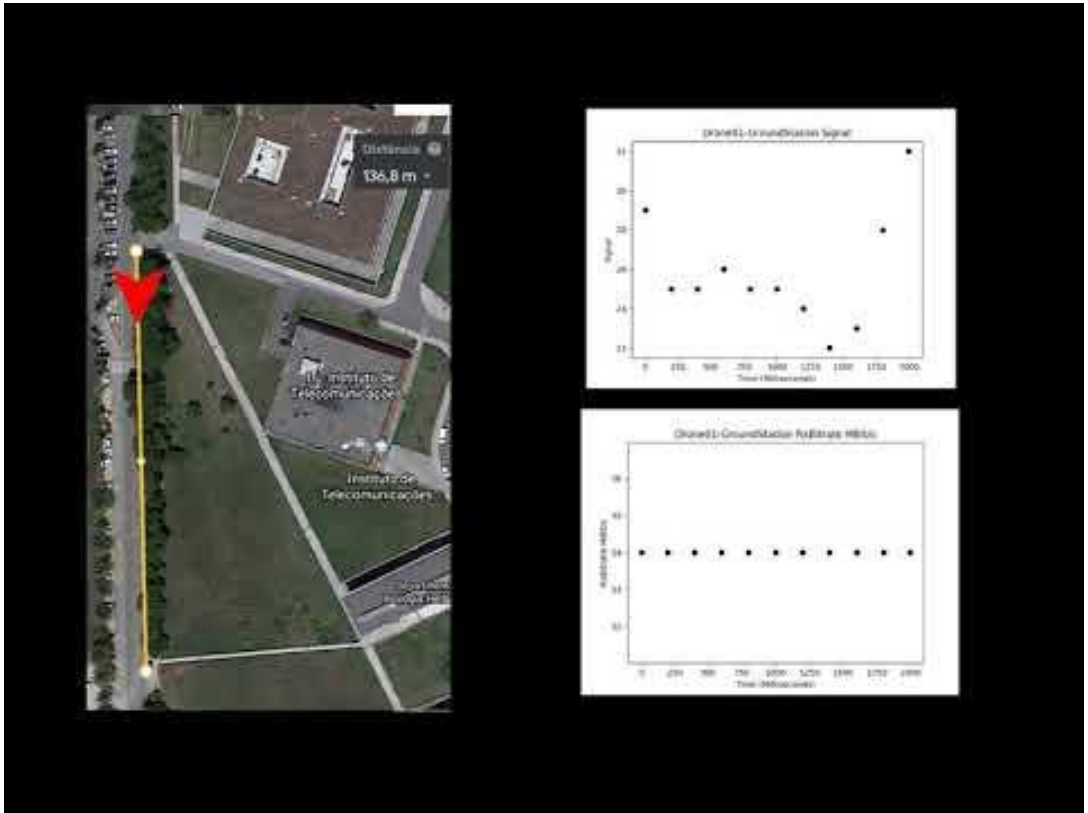




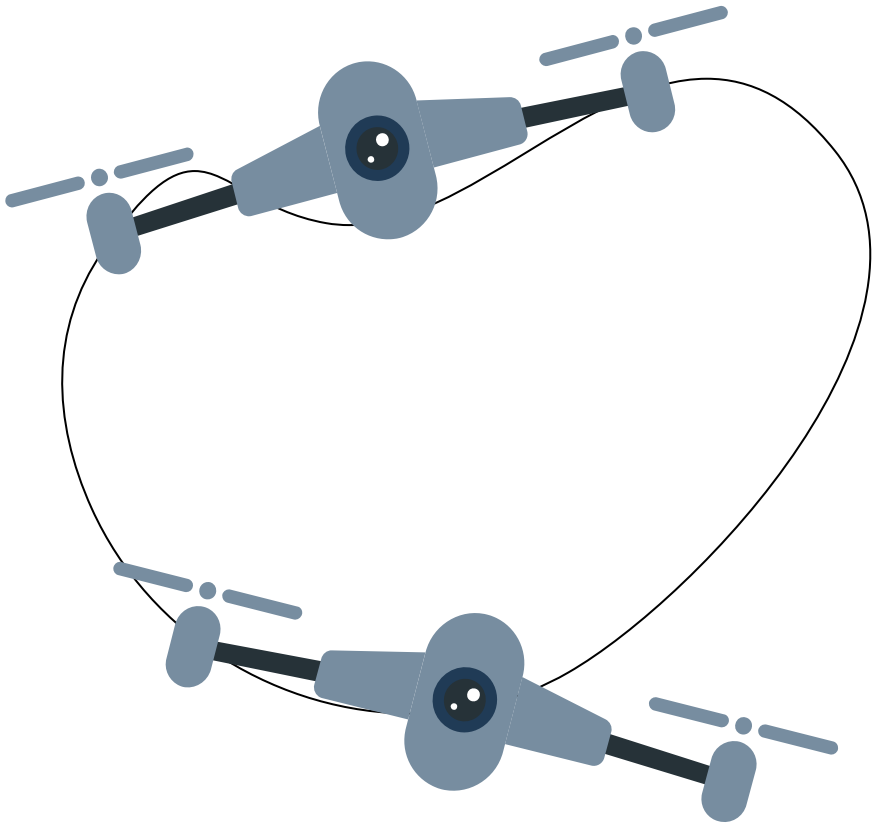


More Examples

Milestone 3 – Video



Videos



Thanks!

Do you have any questions?

Group 8 - Drone Relay - PEI - 2020/2021