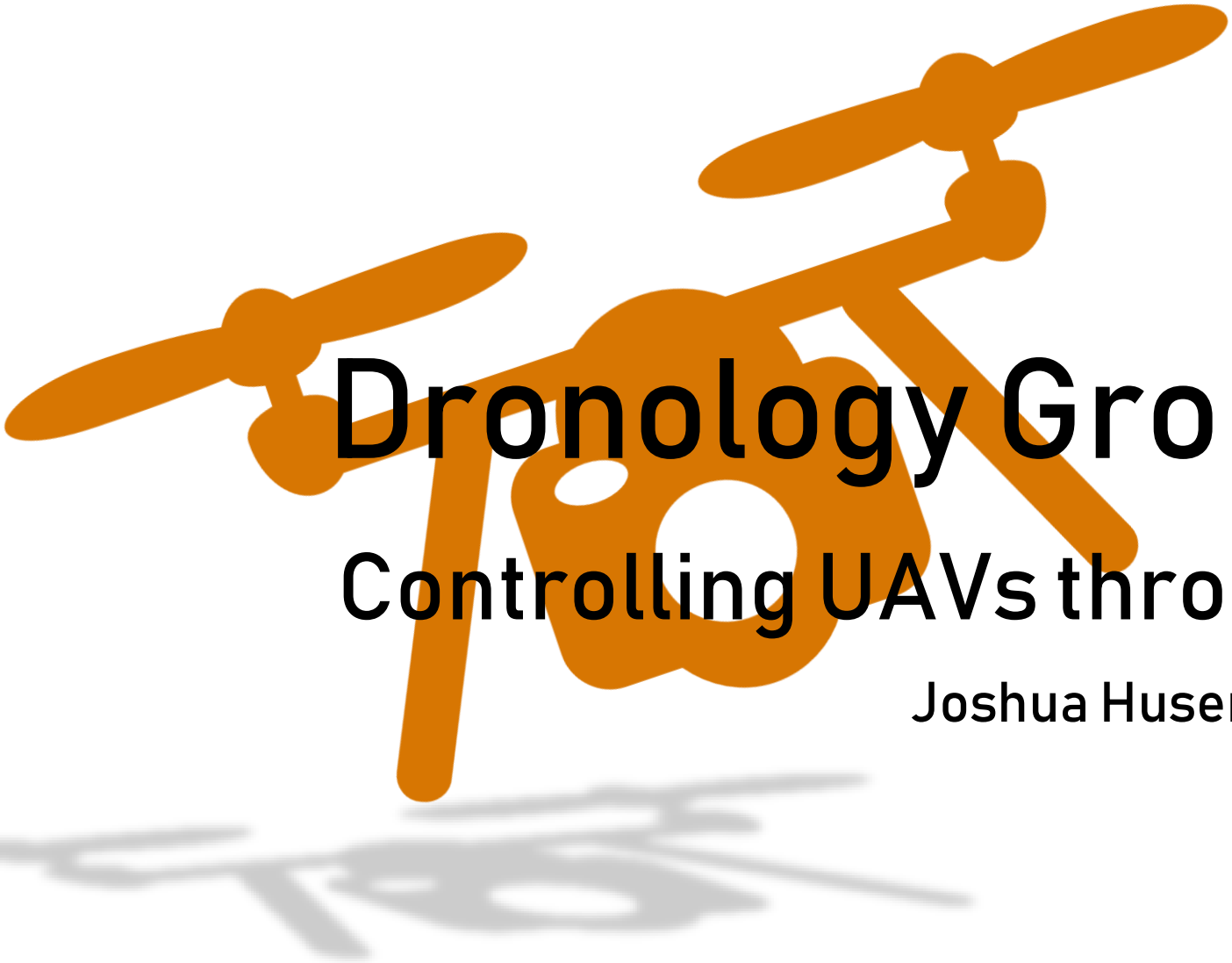


Dronology Ground Station

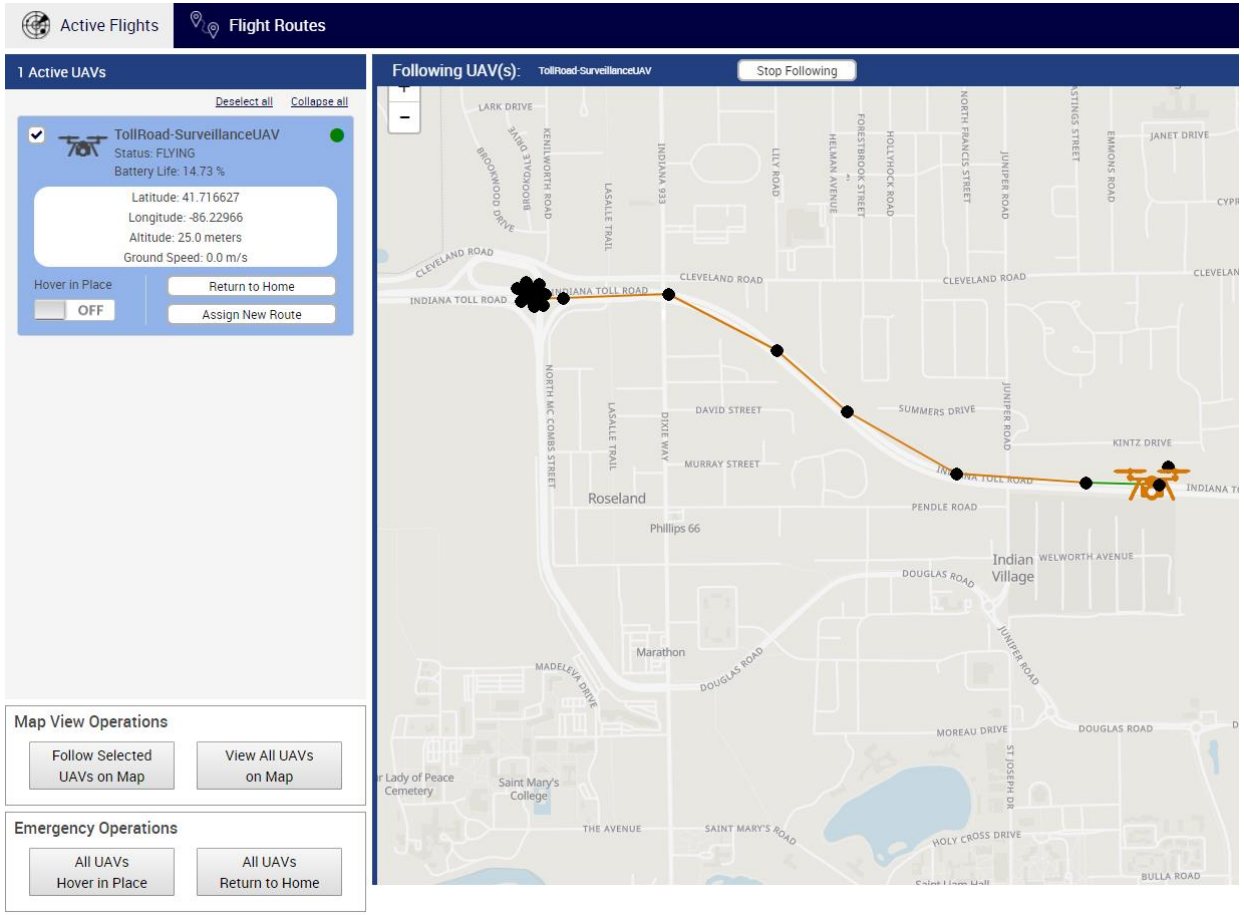
Controlling UAVs through WebSockets

Joshua Huseman

https://dronology.info/

Core Dronology Controller/User Interface

- Java-based core controller dispatches flight routes
- Vaadin (Java web server) user interface handles planning and visualizing flights



Ground Control Station

- Communication bridge between core controller and UAVs
- Relays status messages from UAVs to Dronology Core
- Forwards commands from Dronology to the UAVs
- Pulls RTK GPS correction data from Raspberry Pi server
- Written in Python:
  - DroneKit (http://python.dronekit.io/) for controlling UAVs
  - Socket for communicating with Dronology Core (and RTK server)
- Simple JSON-based communication protocol

JSON Communication Protocol

Each message is a JSON object, with a carriage return (\r) character to signal the end of a message.

```
{
    "type": "handshake",
    "uavid": "PHYS_0",
    "sendtimestamp": 1512454376145,
    "data": {
        "home": {
            "x":  41.698184,
            "y": -86.233975,
            "z":   0.0
        },
        "safetycase": {}
    }
}
```

```
{
    "type": "state",
    "uavid": "PHYS_0",
    "sendtimestamp": 1512454389145,
    "data": {
        "location":{"x":0.0,"y":0.0,"z":0.0},
        "attitude":{"x":0.0,"y":0.0,"z":0.0},
        "velocity":{"x":0.0,"y":0.0,"z":0.0},
        "batterystatus": {
            "current":  0.1,
            "voltage": 12.4,
            "level":  100.0
        },
        "status": "ACTIVE",
        "armable": true,
        "groundspeed": 0.0,
        "armed": true,
        "mode": "GUIDED"
    }
}
```

```
{
    "command": "takeoff",
    "uavid": "PHYS_0",
    "msgid": 1,
    "sendtimestamp": 1512454393145,
    "data":{
        "altitude": 100
    }
}
```

```
{
    "command": "gotoLocation",
    "uavid": "PHYS_0",
    "msgid": 2,
    "sendtimestamp": 1512454399145,
    "data":{
        "x":  10,
        "y": -10,
        "z": 100
    }
}
```

```
{"command":"gotoLocation","uavid":"PHYS_0","msgid":2,"sendtimestamp":1512454399145,"data":{"x":10,"y":-10,"z":100}}
```

RTK Server

- Broadcasts satellite correction data from a stationary GPS receiver to moving GPS on UAVs
  - Corrects position based off of atmospheric disturbance and delay in the GPS signal
  - https://en.wikipedia.org/wiki/Real_Time_Kinematic
- Reads GPS data using u-blox8 protocol (https://www.u-blox.com/en)
- Forwards data over socket to Ground Control Station
- Small python server to run on a Raspberry Pi (https://www.raspberrypi.org/)