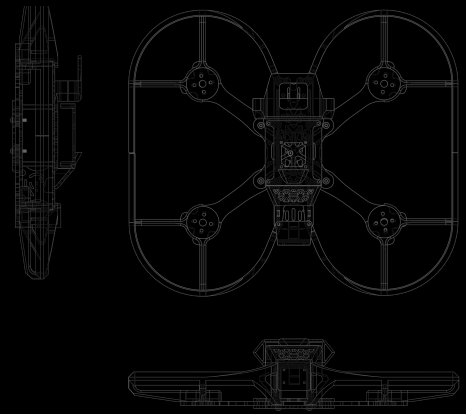
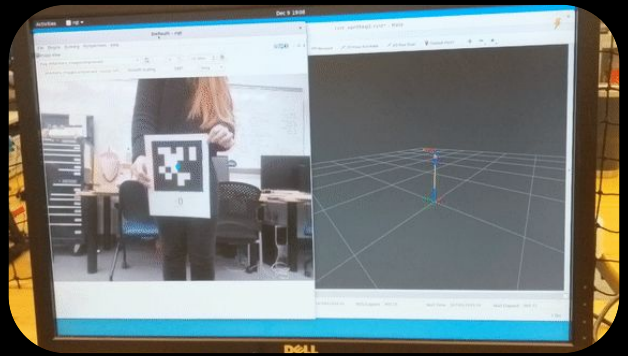
Indoor UAV Navigation with AprilTags

Many typical UAV localization techniques rely on sensors that don't function indoors, such as GPS. In this project, we are integrating a system that allows a small UAV to localize indoors based on AprilTags.

While not yet fully realized, our ultimate goal is to use AprilTags on the floor to let the drone localize (and ultimately navigate) in an indoor setting.





AprilTag to Absolute Position

<u>Some Challenges:</u>

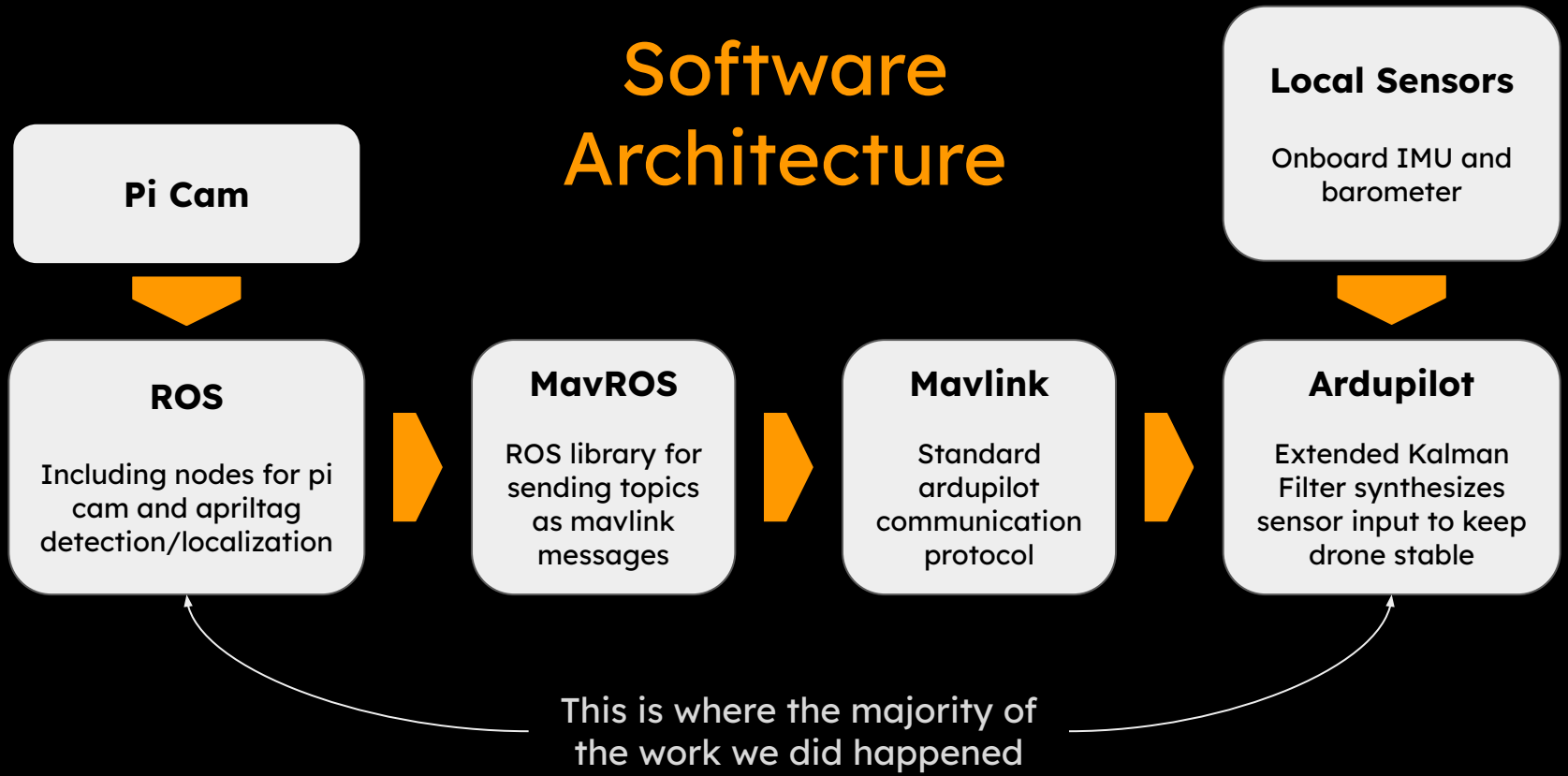
Flight and hardware-in-the-loop testing

Optimization for high enough positional refresh rate

Interfacing a RasPi and a UAV flight controller using ROS

Initial Manual Flight Testing

Software Architecture

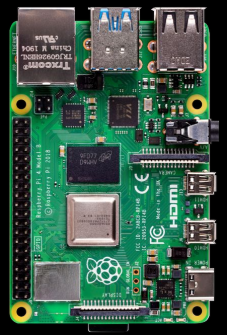


Hardware Architecture

Laptop with ROS for visualization and control

Laptop with Mission Planner for Ardupilot setup

RasPi with Ubuntu ROS Noetic

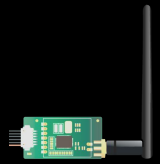


Control UAV by publishing to ROS topics

Controller statuses available as ROS topics

Mavlink (over serial)

Pixhawk Flight Controller Running Ardupilot



Telemetry Radio

Controller

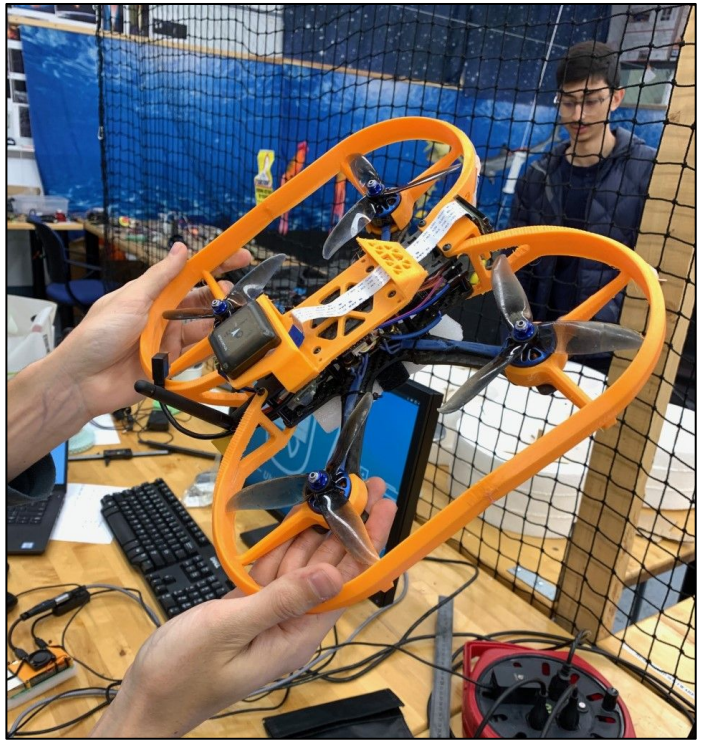
RasPi Cam for CV

GPS + Compass Module for Positioning

AprilTag Navigation

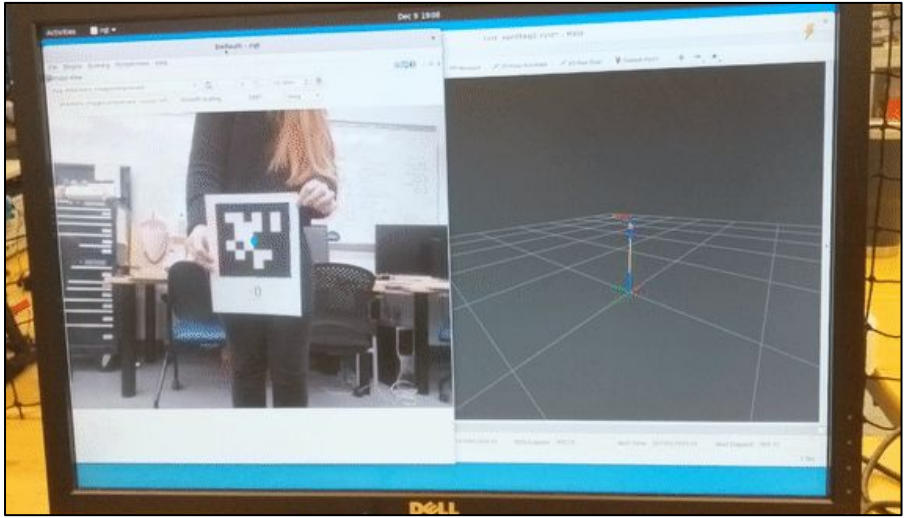
Small quadcopter testing indoor navigation using AprilTags for localization

- AprilTags are fiducial markers
- Mostly a system integration task, but involves computer vision
- Raspberry Pi 4 for vision processing
- Pixracer (ArduPilot) for flight control
- Website: uav-control.github.io

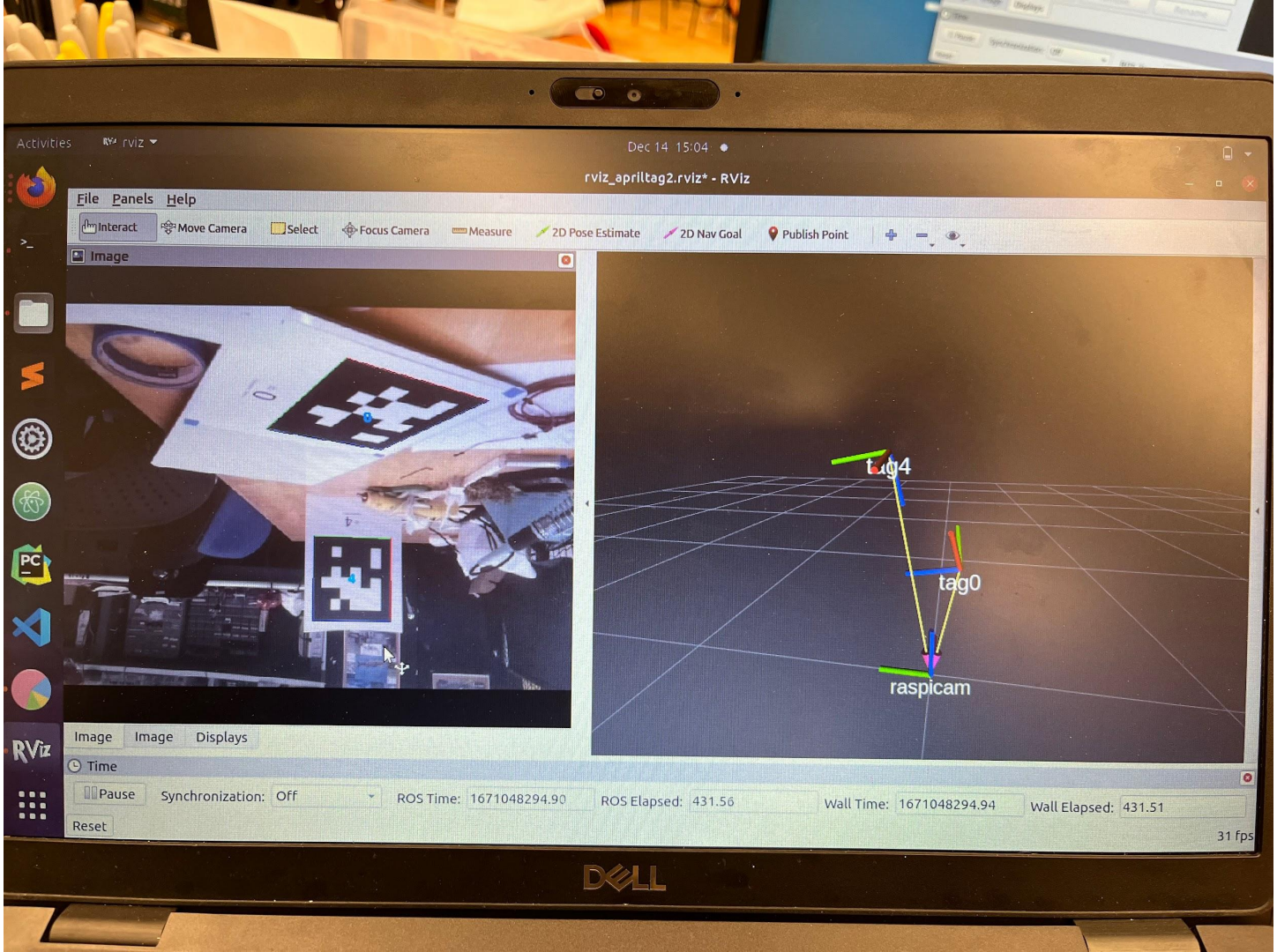


AprilTag Navigation (Lilo and Tigey)

Recognizes AprilTag pose at a rate of ~10 Hz, more when visualization is off



Initial flight test under manual control (airframe test, no localization yet)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Displays
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Wall Time:
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