Simultaneous Localization and Mapping on an Autonomous Quadcopter

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SLAM on a Low Cost Quadcopter

- Develop an autonomous platform that that would allow for both real time mapping and localization of the system
- To establish a starting point that would allow for future autonomous development

3D Mapping for Search and Rescue

- Finding victims in unknown terrain can be slow, dangerous, and costly
- My project aims to resolve this issue by providing a relatively low cost (~$1200) solution that would allow rescue organizations the real-time information they need to save lives.
- Establish the basis for a system that can help provide critical insight to those who would need it in saving lives through the use of an autonomous quadcopter with real-time mapping abilities
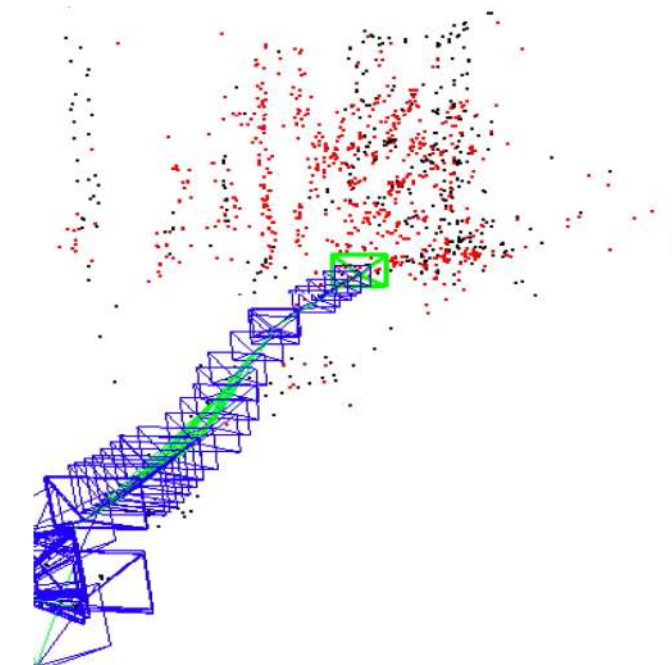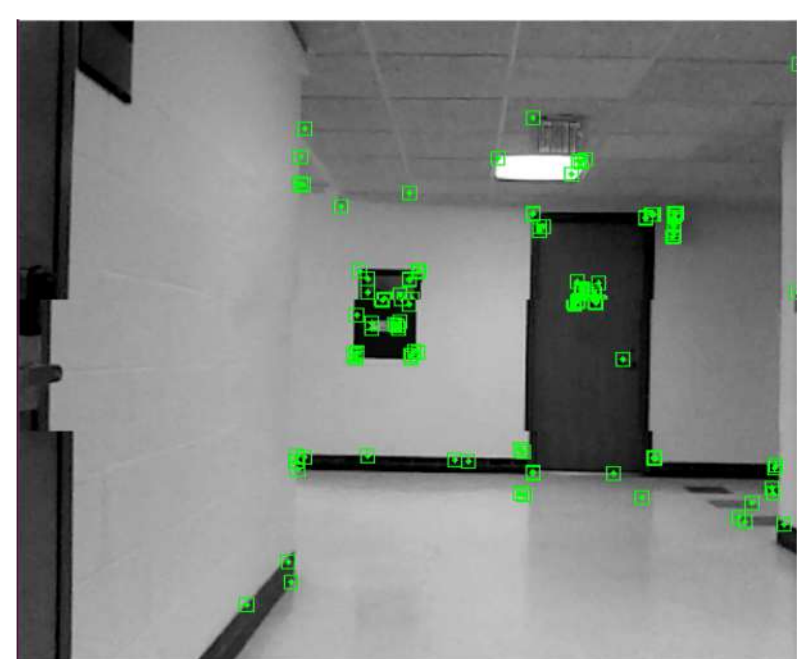
Acknowledgements

- My advisor Bruce Land for not only supporting my project but also funding it when alternative funding fell through
- Kirstin H. Petersen for helping me find uncommon parts used to interface with the Intel Aero RTF Quadcopter
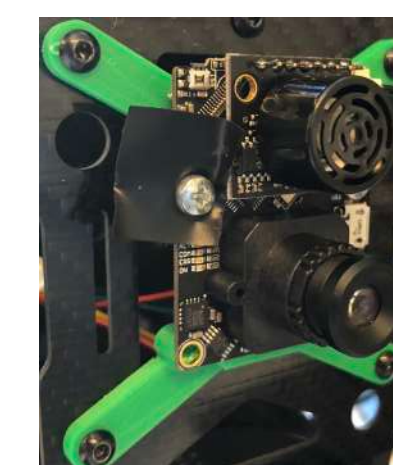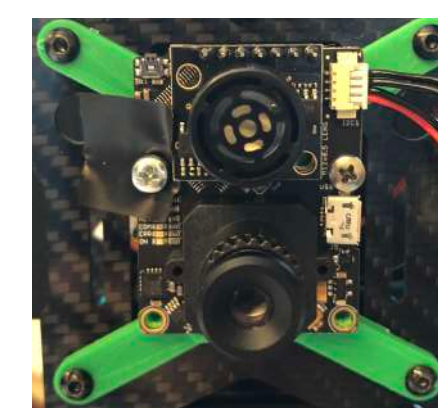- ECE Squad for keeping me motivated

Quadcopter Systems Integration

Hardware Design:
The following pieces of hardware in this system was purchased and then integrated and

| Intel Aero RTF	PX4Flow Optical Flow Chip

Software Design:
There are several different pieces of software that compose the final system, each with a different function:

- QGroundControl: Used as Quadcopter's base station
- ORBSLAM2: Used for real time SLAM
- ROS: Used to integrate RealSense cameras with ORBSLAM2, and MAVLink based autonomous flight code
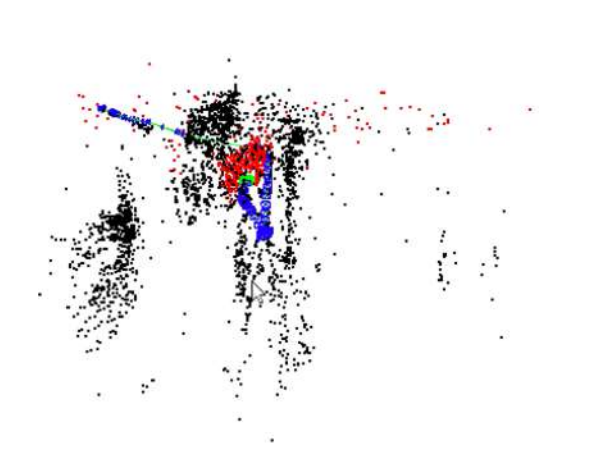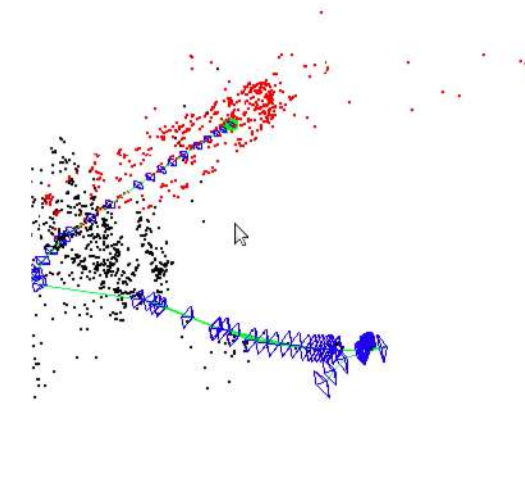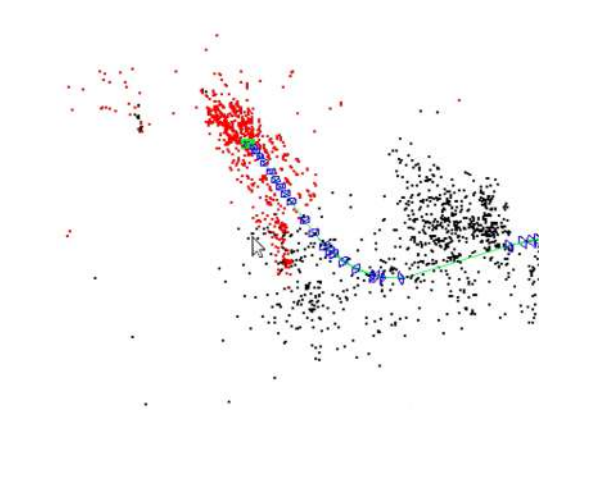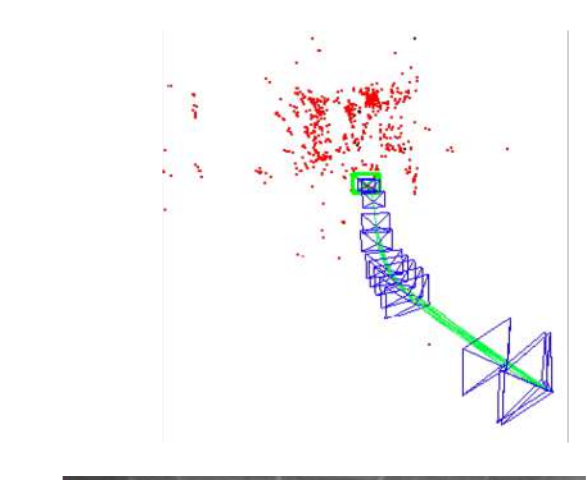- DroneCore SW: C++ custom code to control basic flight
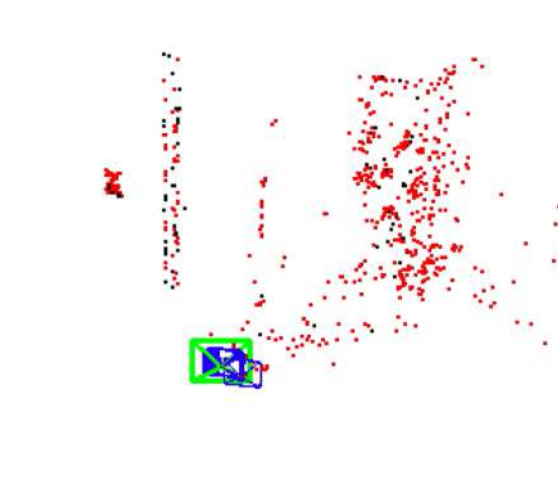
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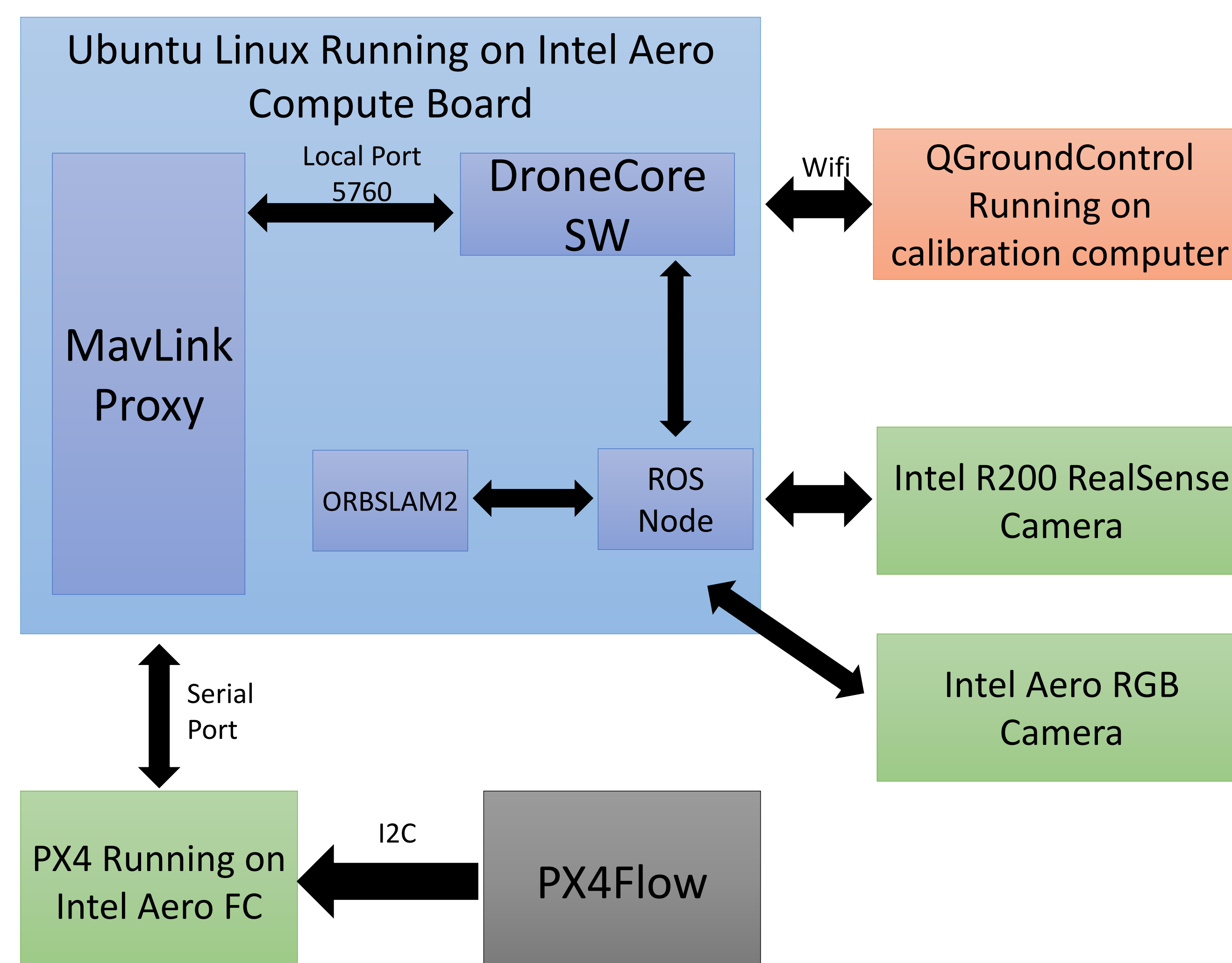
Autonomous Hover and Realtime SLAM

Stable Hover using optical Flow


SLAM using Intel RealSense Camera

Fully Autonomous Integration

- Autonomous Take-Off
  - Main delay in fully autonomous flight
  - Had to postpone takeoff testing due to signal noise making autonomous flight dangerous
- Autonomous Navigation
  - Code written but cannot be fully tested till autonomous takeoff established

Autonomous Mapping is viable and cost effective

- Sensor technology is at the point where autonomous aerial navigation is becoming cost effective
- Fully autonomous flight still requires more sensors than the base Aero RTF and PX4Flow board can offer
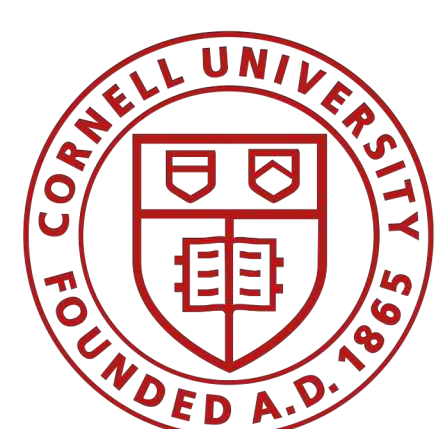
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