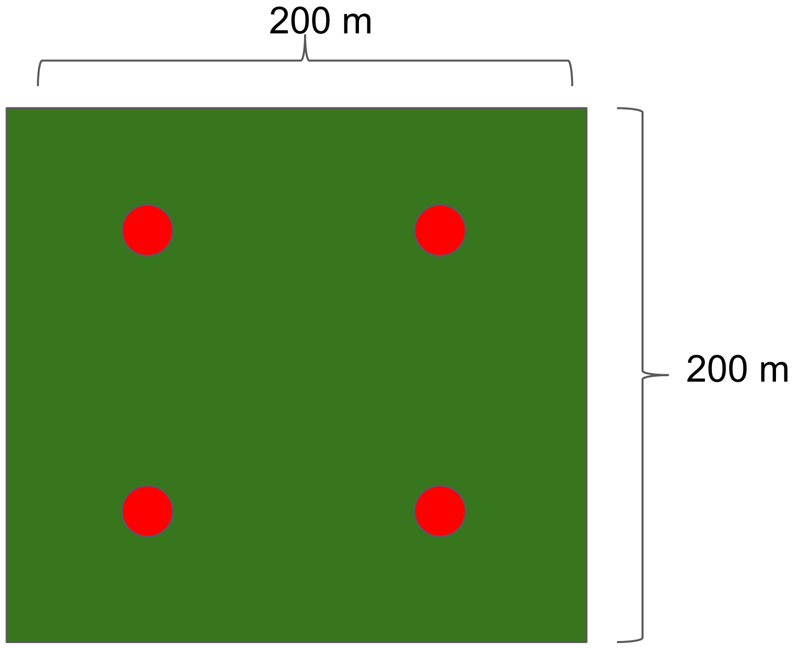
Team F Progress Review 1

- Sensors
  - Thermal imaging camera(Sumit)
  - RGB Camera(Henry)
  - Sound sensor(Karthik)
- Navigation Pattern (Sumit)
- Ramp-up on DJI operability (Xiaoyang)

Presenter: Xiaoyang Liu

Figuring out the navigation pattern



Search area:

- 200m x 200m
- 4 locations of interests

How can we optimize the search?

Trade-off between flight time, resolution and coverage

What should be the optimal altitude, speed?

Thermal Imaging camera: FLIR Tau 2 LWIR

Key Specifications:

- Uncooled VOx Microbolometer
- 19 mm lens
- 29.97 Hz frame rate
- Resolution: 640 x 512
- Field of View: 32º x 26º
- Spectral band: 7.5 - 13.5 µm

RGB Camera

Key specifications:

- Resolution: 4240 x 2824(12MP)
- 7 FPS
- Readout Method: Global shutter
- Sensor Format: 1"
- Lens Type: TC2016-21MP
- Focal Length(mm): 20
- Angle of View: 36.1° x 27.2°

GRASSHOPPER3 12.0 MP COLOR USB3 VISION (SONY ICX834)

Sound Sensor

Usecases

1. Using human voice as a signature to detect likely rescue location
2. Using sound for localization to drop rescue packet accurately.

Requirements

1. Ability to record unidirectional sound - Cardioid/Hypercardioid microphones
2. Ability to reduce/filter out prop noise

Models considered

1. DPA lavalier cardoioid microphone (20-20K hz)
2. M-Audio Nova cardoioid microphone (20-18k hz)

Sound Sensor

Post Processing

1. Adobe audition
2. WebRTC for VAD
3. RPM-frequency models for prop noise cancellation

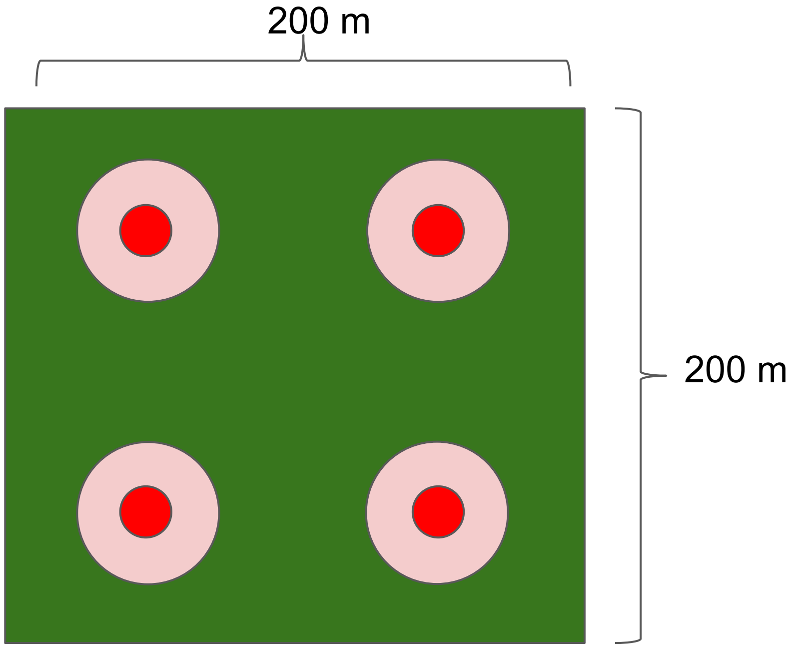
Risks

1. Impact of background noise from propeller and wind

Mitigations

1. Use of a different sound source like a safety whistle (3K hertz)
2. Use a mechanism to lower the microphone clear of prop noise

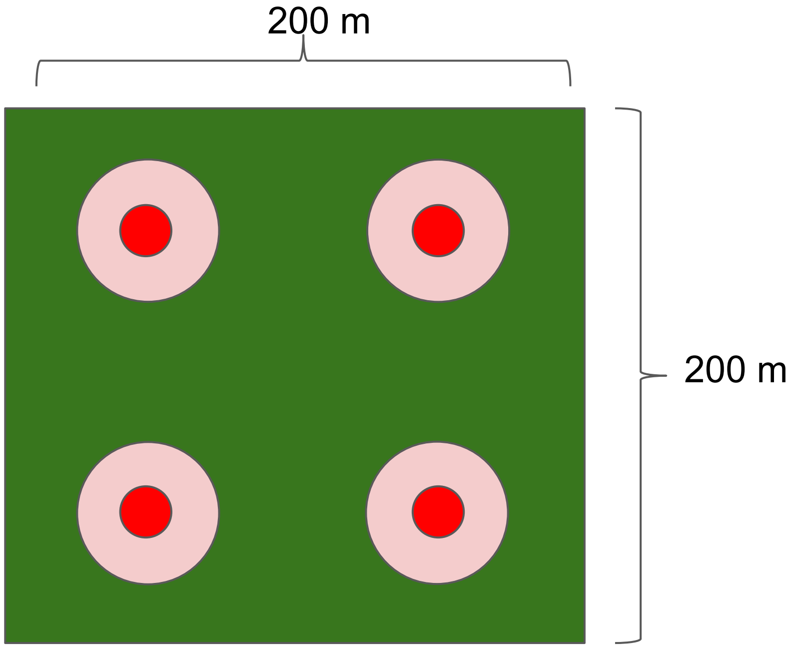
Figuring out the navigation pattern



Initial Strategy:

- Reach location of interest at an altitude of 15 m, speed ~5 m/s
- Spiral up to an altitude of 30 m, complete one circle of radius 6 m, speed ~2m/s
- Move to the next location of interest while reducing the altitude to 15 m

Figuring out the navigation pattern

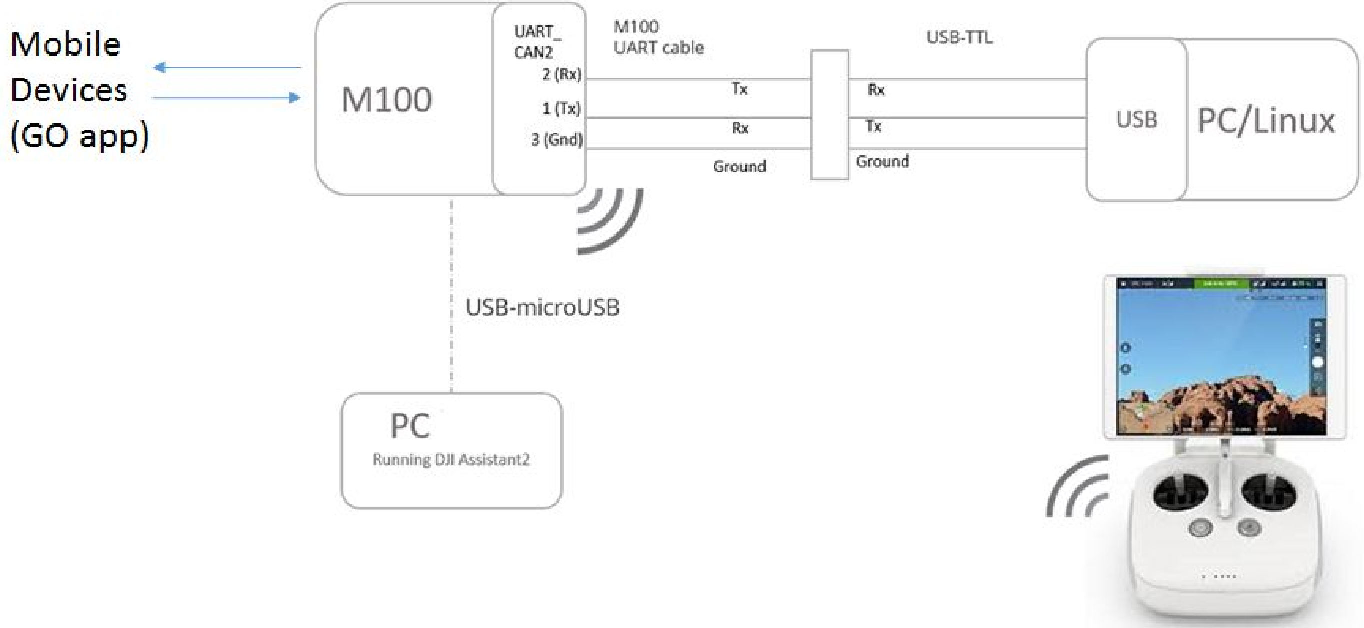


How does our initial strategy do?:

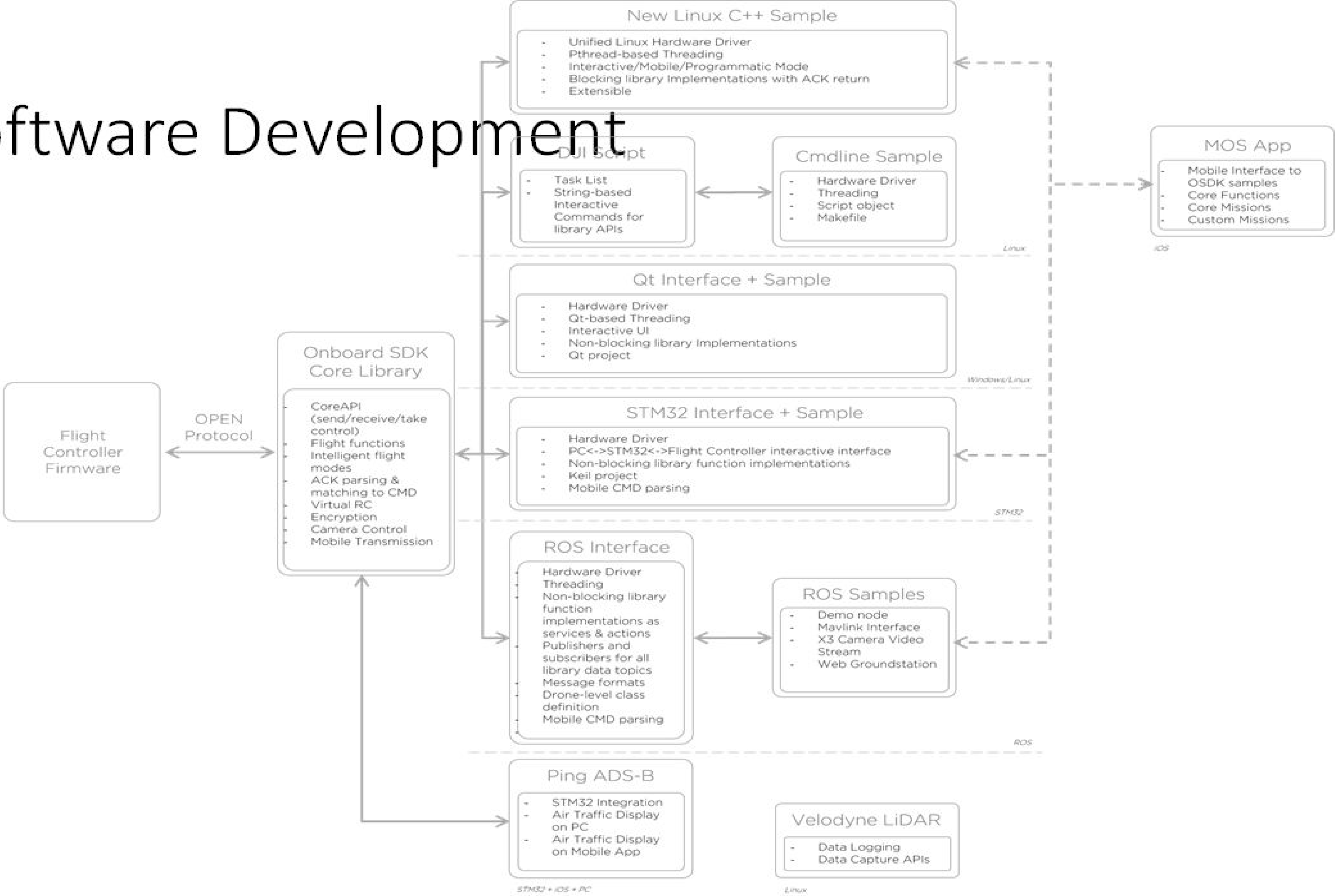
- 44m diameter circular area covered around each location of interest
- >98% overlap between two frames for both thermal and RGB cameras - good stitching
- Well detailed imagery
  - **Ground sampling distance:** 0.5 cm/pixel for RGB, 2.7 cm/pixel for thermal
- All done within 4 minutes!

DJI Ramp-up

The hardware connection



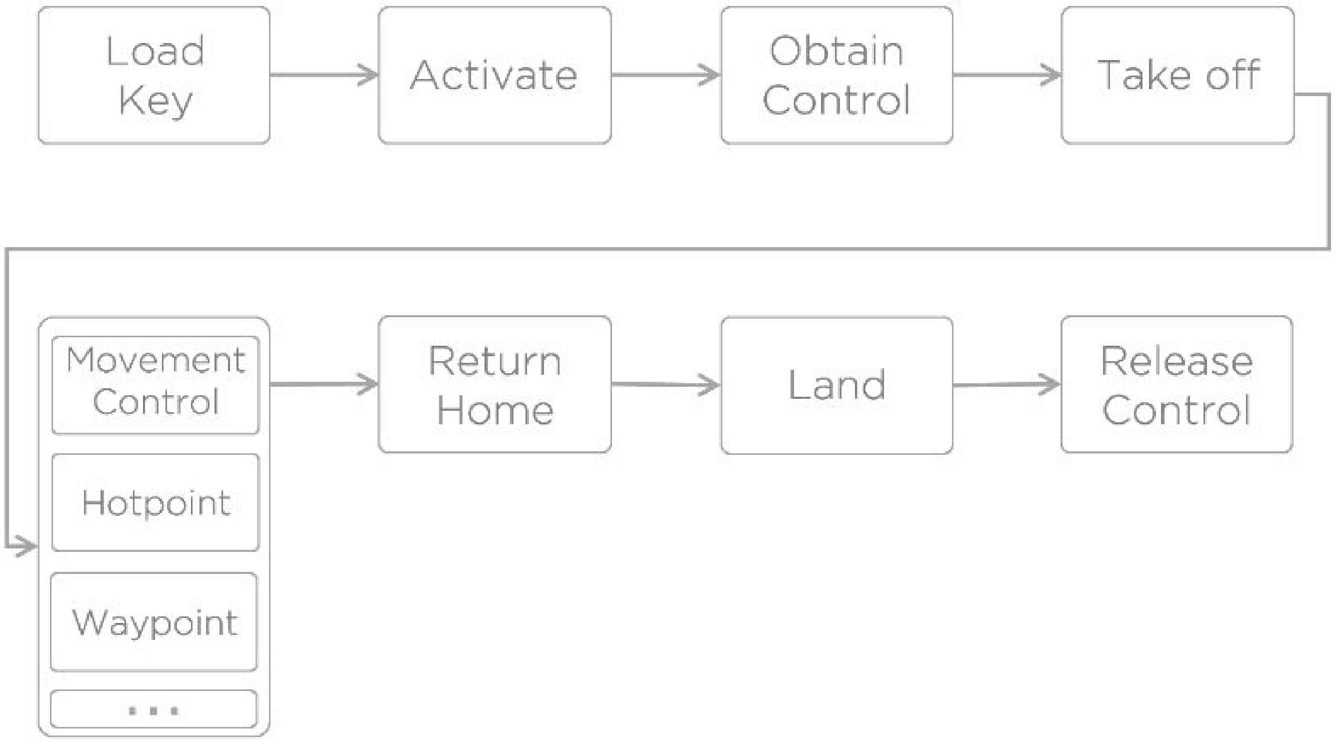
Software Development



Choosing the Right Platform

- 1. Custom Applications on Linux/Windows
  - DJI API, two for a Linux target (GUI-based sample built using Qt and C++ sample built using CMake) or for a Windows target (GUI-based sample built using Qt)
  - We can write applications with zero overhead by using the DJI API as a starting point.
- 2. High-Level Applications on ROS/Linux
  - Maybe later for integrating the DJI Onboard SDK into larger ROS projects
- 3. Applications on Embedded Systems(STM32)
  - Plan to have additional processing (e.g. computer vision) in our application

Onboard SDK Programming Workflow



Ground Station CMD Set : WayPoint

CMD Set	CMD Group	CMD ID	Description
0x03	Waypoint	0x10	upload waypoint task data
		0x11	upload tde waypoint data witd certain index
		0x12	start/stop waypoint mission
		0x13	pause/resume waypoint mission
		0x14	download waypoint task data
		0x15	download certain waypoint data witd given index
		0x16	set waypoint mission idle velocity
		0x17	read waypoint mission idle velocity

Movement Control

- position control
- attitude control
- velocity control

Thanks

Q&A