Meeting Materials for QDrone Project Regular Internal Meeting

Regular Internal Meeting for QDrone Project

Jan 7 2019

4PM at PSE 312

Participant: Jungwon Kang, Zahra Arjmandi, Kunwoo Park

Prerequisites for Pursuing Project

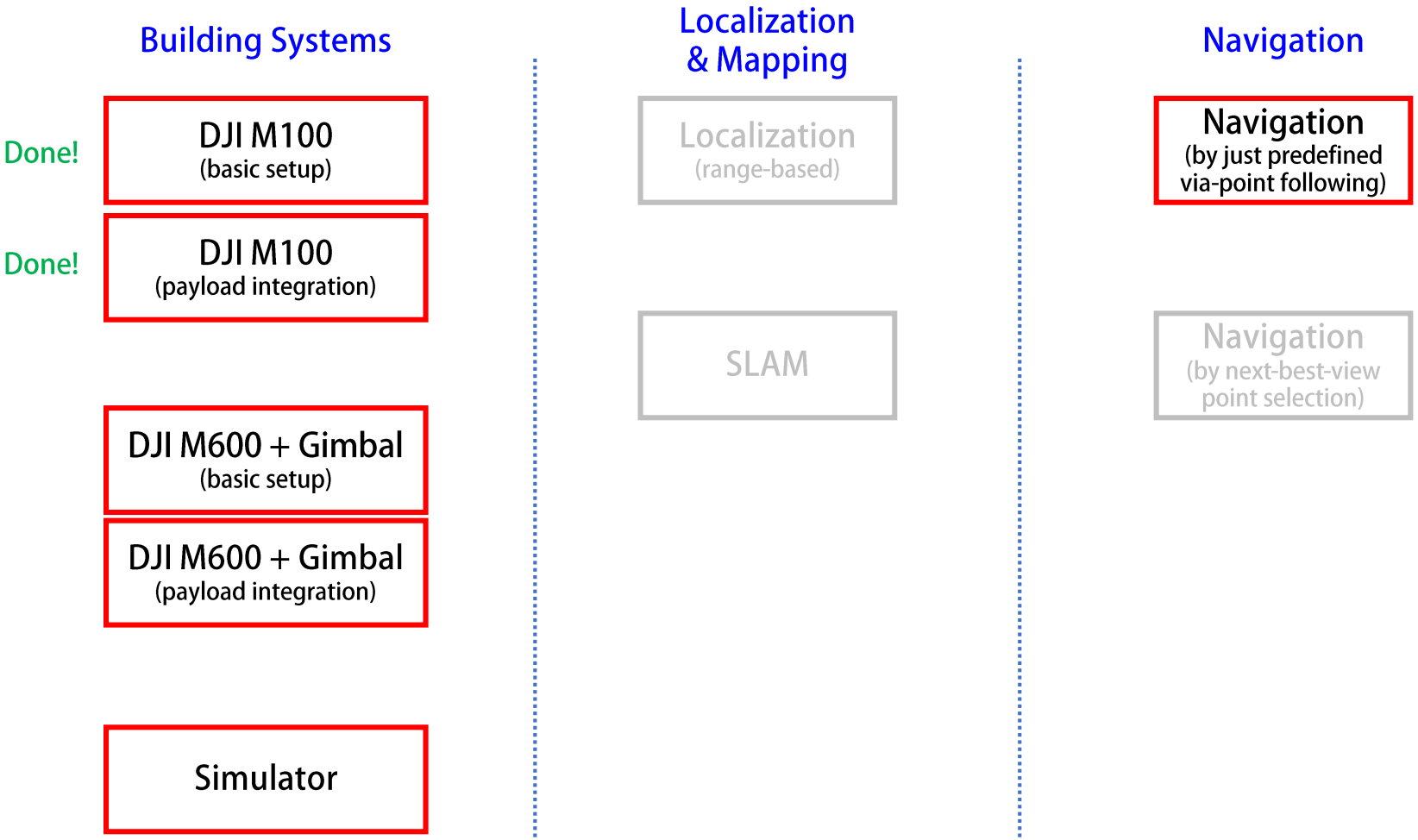
- Software
  - Matlab
  - C++
  - Ubuntu
  - ROS
- Theory (for backend: state estimation from sensor measurement)
  - EKF
  - MSCKF
  - Smoothing
- Sensor
  - GPS
  - IMU
  - Camera
  - LiDAR

Tasks

- Task 0: Building Systems
- Task 1: Localization
- Task 2: SLAM
- Task 3: Navigation

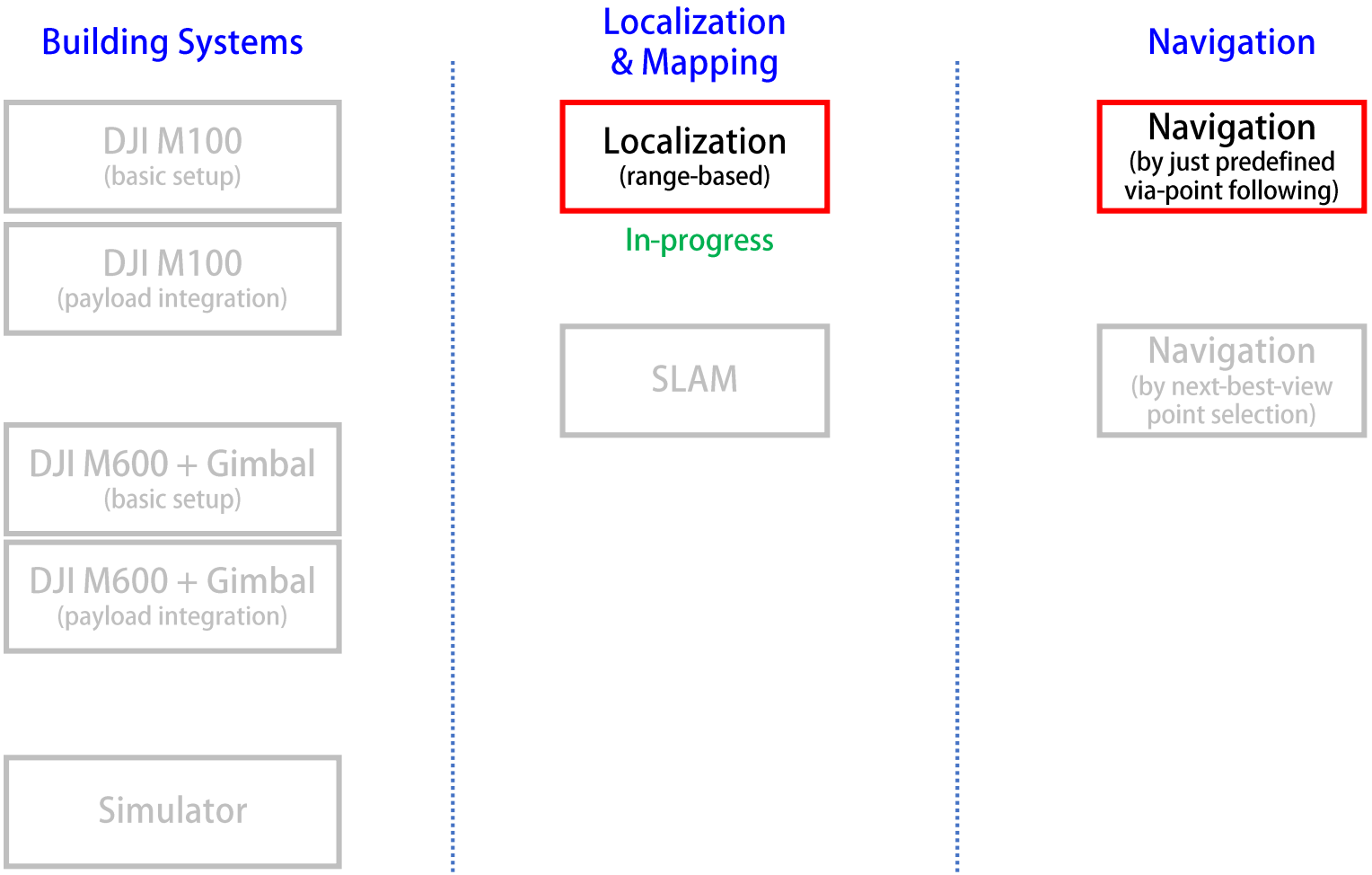
Task 0: Building Systems

❑ Building Complete Systems



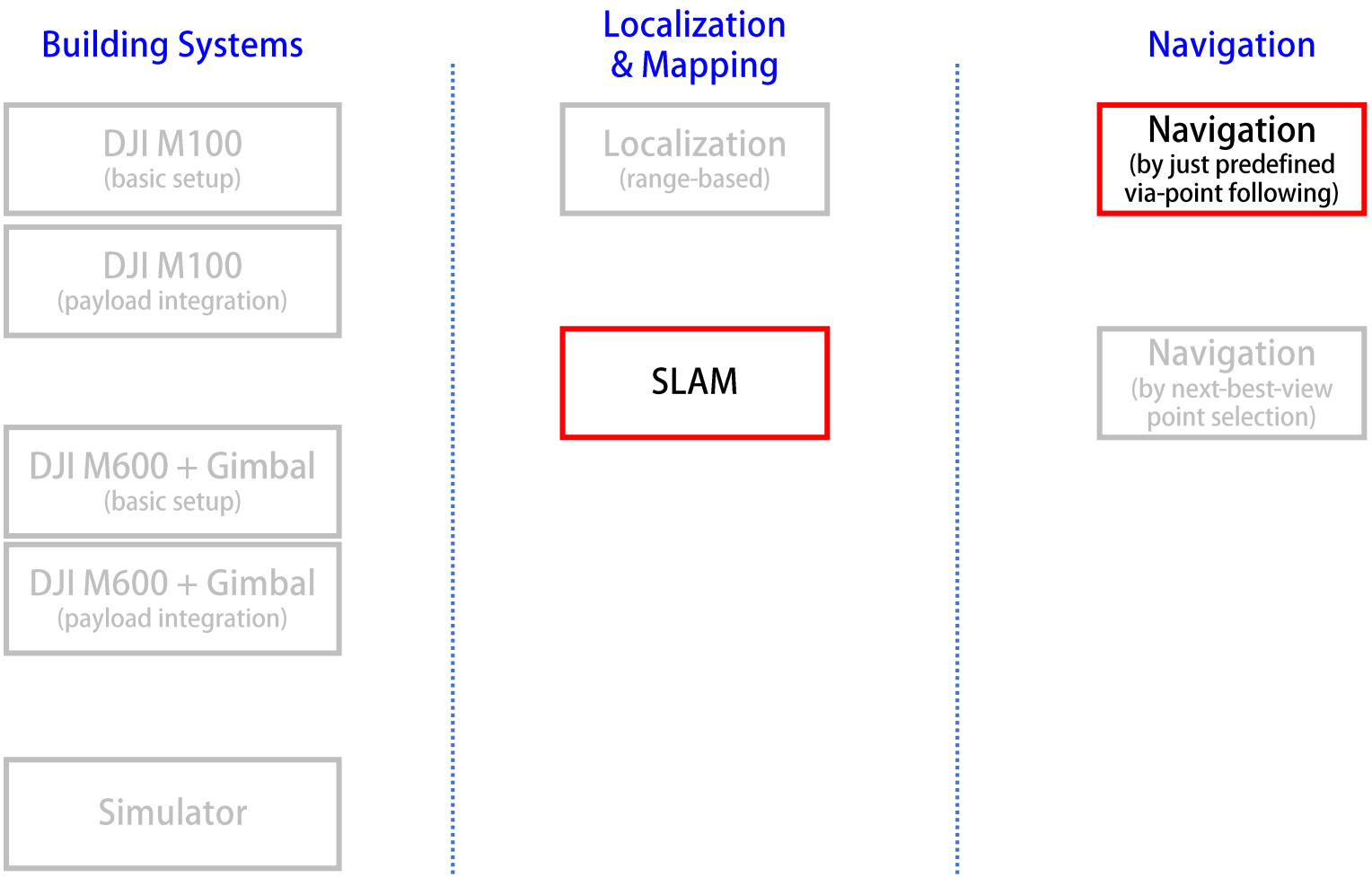
Task 1: Localization

❑ Following Predefined Via-Points



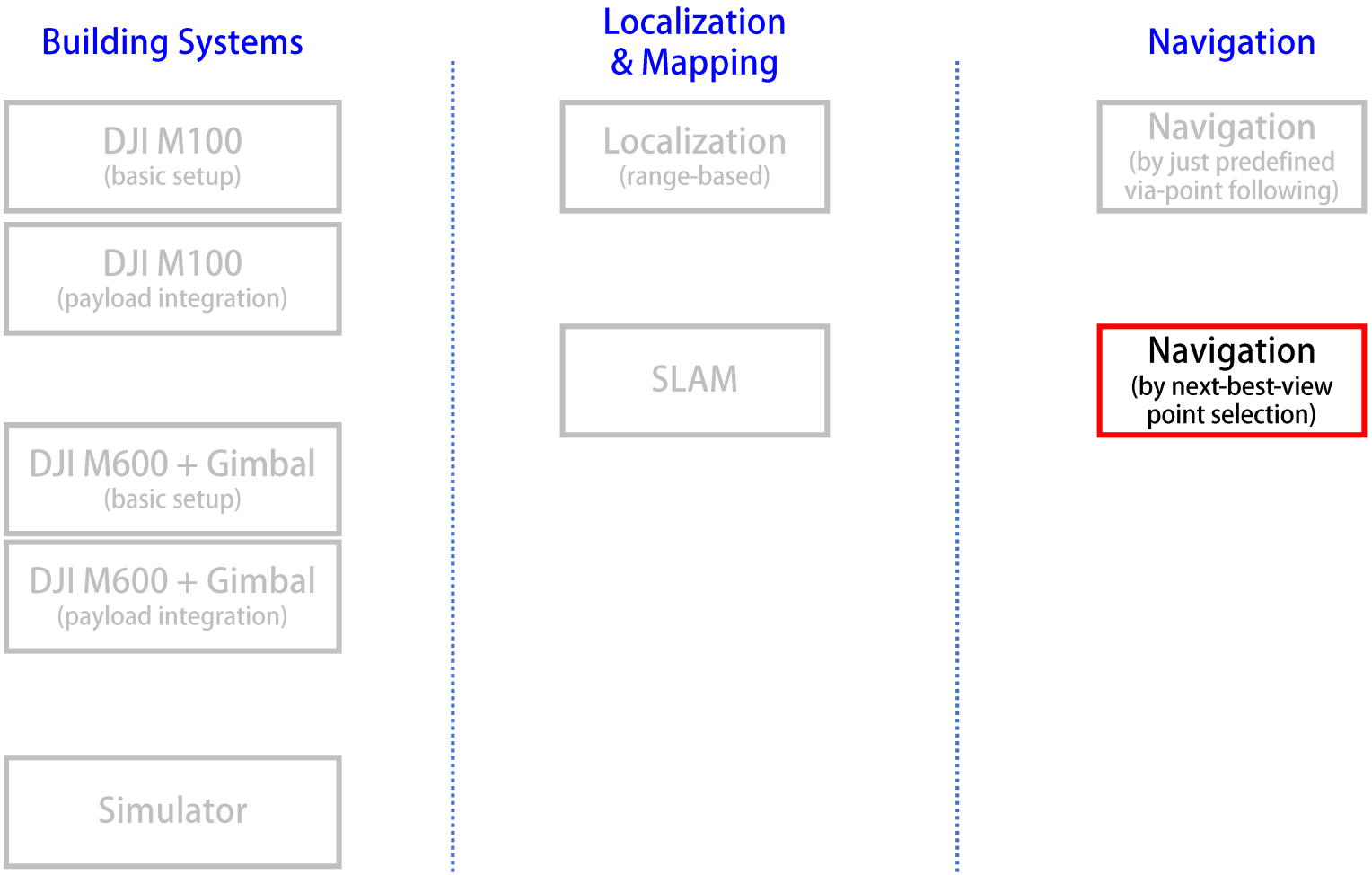
Task 2: SLAM

❑ Building a Map



Task 3: Navigation

❑ Building a Map by Next-Best-View Point Selection



Meeting Results: What to do

- Common
  - Basic setup for 'DJI M600 + Gimbal' (primarily by Zahra & Kunwoo)
  - Booking a PSE 4th floor room equipped with motion capture systems

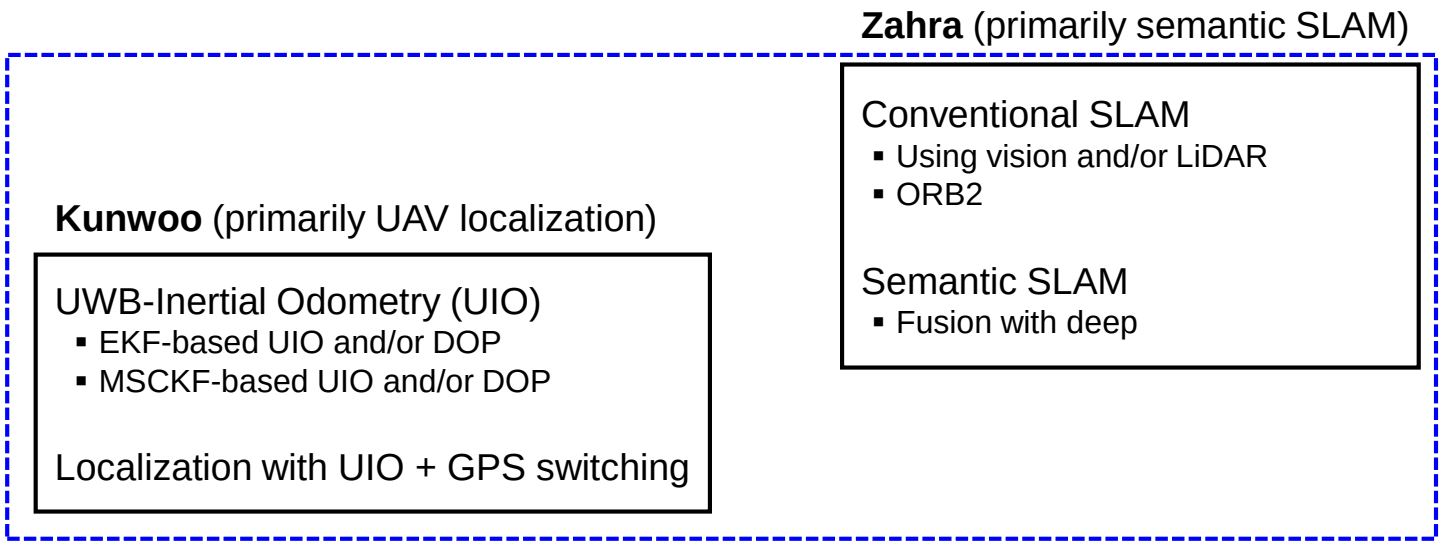
- Zahra
  - Understanding Kunwoo's EKF-based UWB localization code (including EKF)

- Kunwoo
  - Sending thesis and experiment plan to prof. Sohn
  - Writing a paper for ISPRS Geospatial Week 2019

- Jungwon
  - Writing a paper for IROS 2019

Future Plan

❑ Jungwon's Rough Suggestion for Future Plan



Jungwon: supports Kunwoo & Zahra mainly in technical issues.

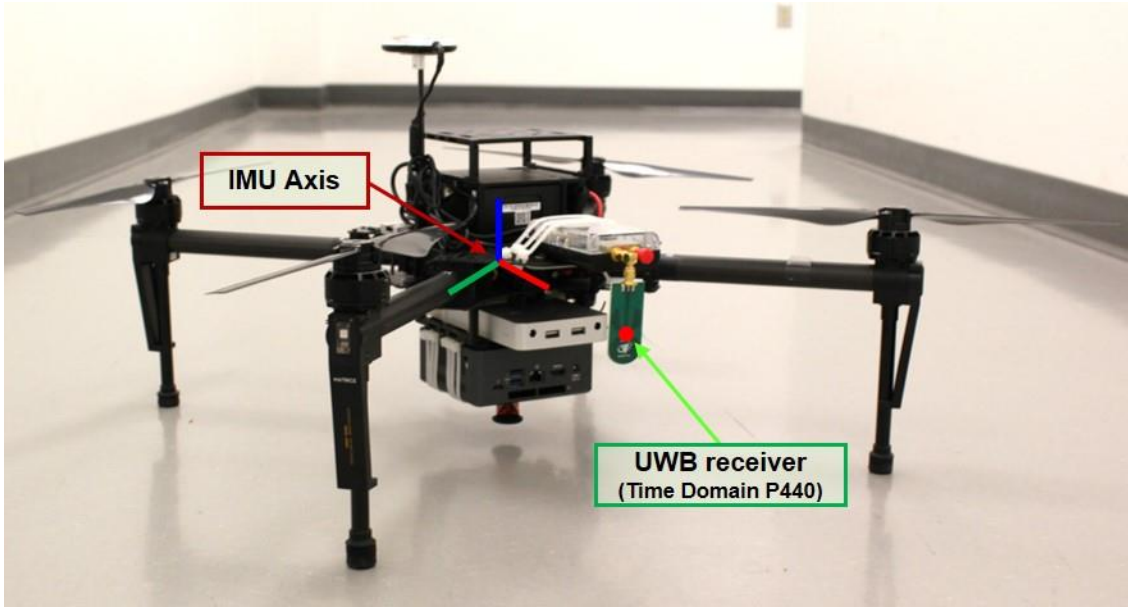
IMU Calibration Problem

Jan 24 2019

Participant: Jungwon Kang, Zahra Arjmandi, Kunwoo Park, Yujia Zhang

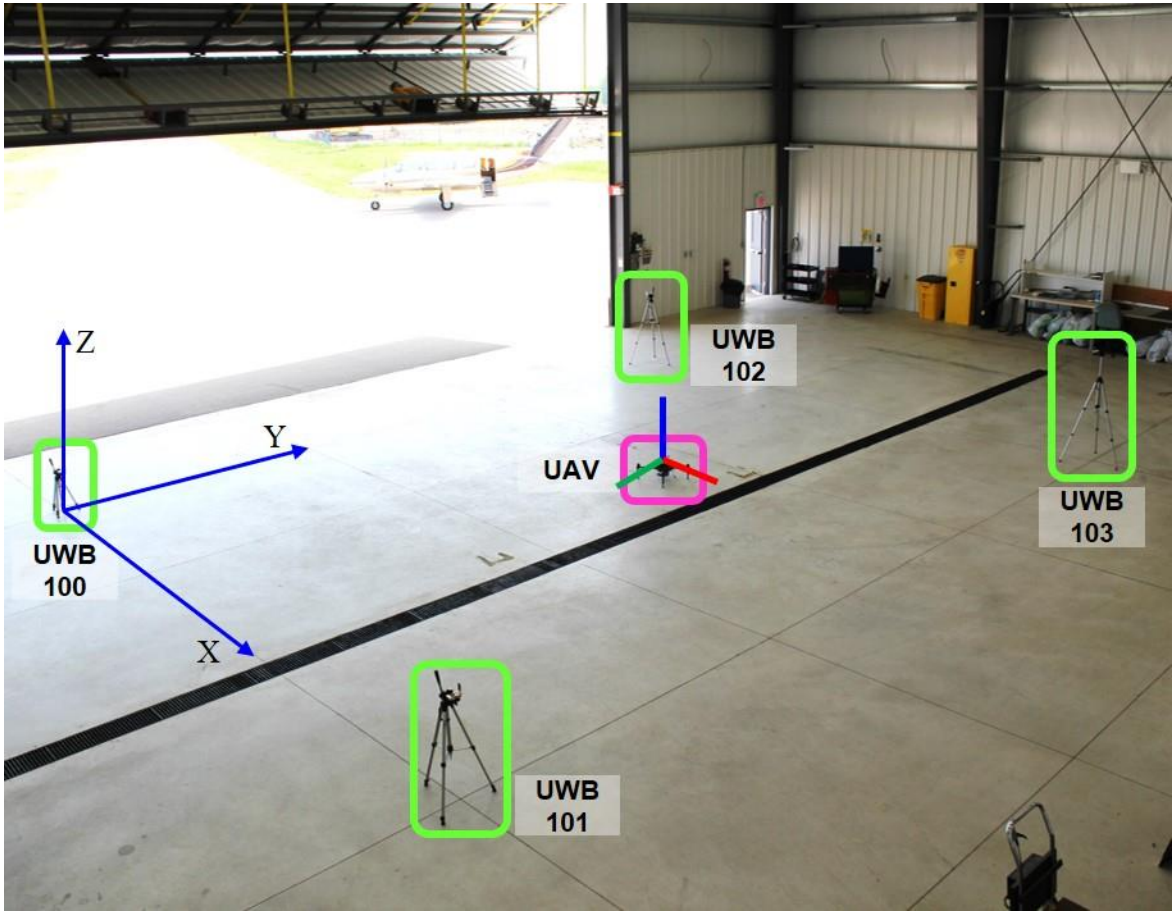
Problem 1

- Where is the UWB receiver wrt IMU axis?



Problem 2

- What is the initial R, T between UWB axis and IMU axis?

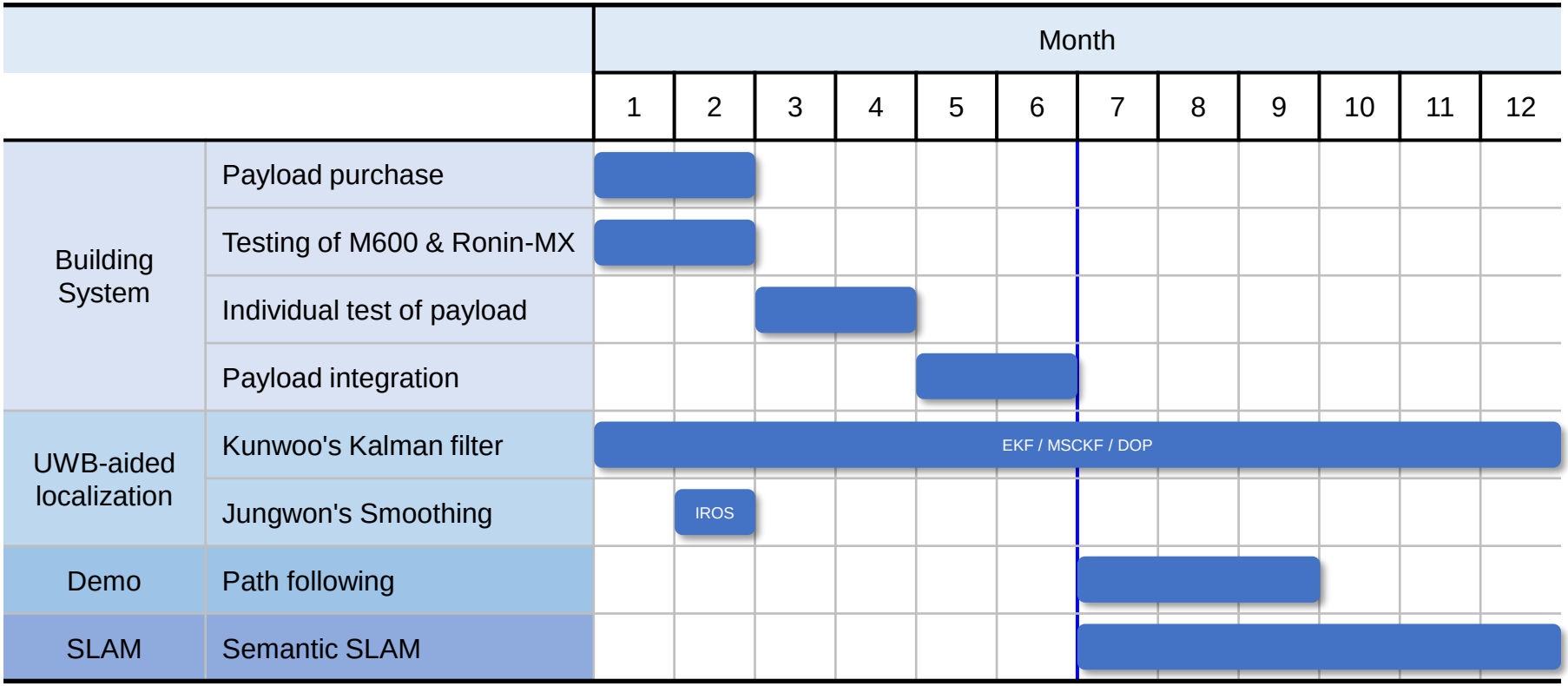


Plan for Year 2019

Feb 5 2019

Participant: Jungwon Kang, Zahra Arjmandi, Kunwoo Park

Plan for Year 2019



Payload

- Positioning sensor: Pozyx / Spatial / DJI-RTK
- Imaging sensor: ZED stereo / FLIR Duo R / Sony A7III
- Velodyne LiDARs: Puck LITE / Puck Hi-Res / HDL-32E

Current Progress & To do next

Mar 10 2019

Jungwon Kang

Current Progress & To Do Next

Subject	Detailed Task	Current Progress	To Do Next
System building	Payload purchase	▪ Received Velodyne Puck Lite & Hi-Res	▪ Receiving the rest of ordered items (All items are listed at the bottom of page.) ▪ Need to buy a cabinet with lockers ▪ Making a list of items
	Testing M600 & Ronin-MX	▪ Tested Ronin-MX ▪ Not tested M600 due to a broken battery ▪ The broken battery (TB48S) was delivered to the OmniView tech.	▪ Need to order extra TB48S batteries. (Need $2000 for six TB48S)
	Test of each payload	None	
	Payload integration	None	
Dataset release	UWB-IMU dataset generation & release	None	▪ Need to do experiments ▪ Need to release the dataset to the public ▪ Need to submit a paper about the dataset
Localization solution	UWB multilateration-based localization	▪ Implemented an initial version of multilateration in C++	▪ Need to implement LM non-linear optimization in C++
	UWB-EKF-based localization	▪ Implemented in MATLAB (by Kunwoo)	▪ Need to implement in C++ ▪ Need to write a thesis draft by Kunwoo
	UWB-Smoothing-based localization	▪ Implemented in MATLAB (by Jungwon) ▪ Submitted IROS paper	▪ Need to implement in C++
Navigation solution	Coverage path planning	▪ Implemented in MATLAB (by Zahra)	
	Implementing in real systems	None	▪ Need to implement in M100 & M600

Payload

- Positioning sensor: Pozyx / Spatial / DJI-RTK
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Current Tasks

Task 1. Testing & Labeling of Items
Task 2. Implementation of Waypoint Following

April 11 2019

Jungwon Kang

Task 1. Testing & Labeling of Items

Item List (Apr 11 2019)

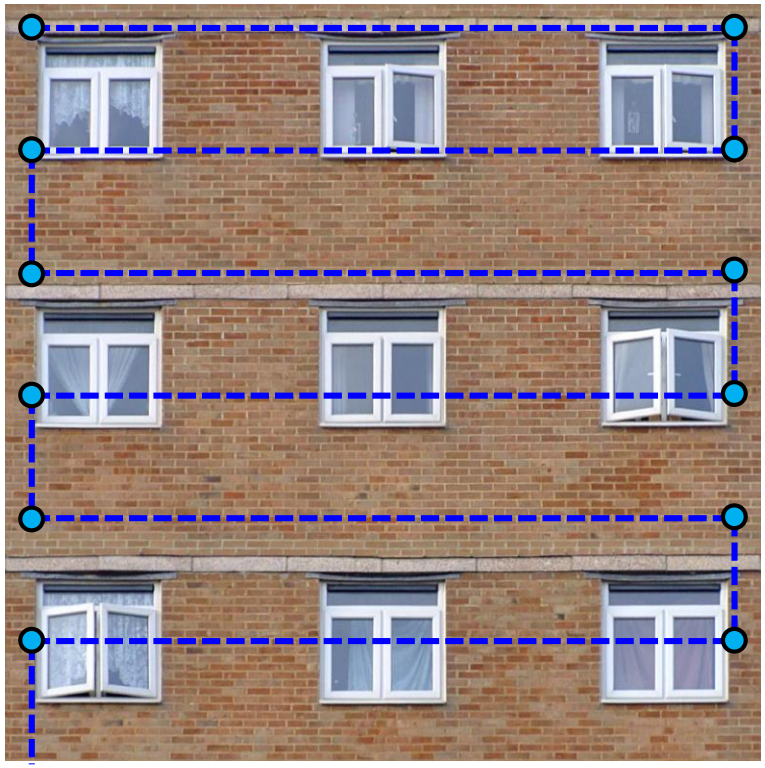
Type	Item Name	Components	Delivery State	Testing State
Drone	DJI M600 Set	M600 body / Ronin-MX Gimbal / 2 RC / Batteries / RTK-GPS		Partially done
Drone	DJI M100 Set	M100 body / RC / Propellars / Batteries / A3 FC / Lightbridge		Partially done
Drone	DJI Mavic Air Set			Done
IMU	Spatial		Not delivered yet	Not done yet
UWB	TimeDomain	5 UWB modules / 5 Batteries		Done
UWB	Pozyx		Not delivered yet	Not done yet
LiDAR	GeoSLAM	Scanner / Data logger / Dongle USB		Done
LiDAR	Velodyne Puck LITE			Not done yet
LiDAR	Velodyne Puck Hi-Res			Not done yet
LiDAR	Velodyne HDL-32E			Not done yet
Camera	Sony A7III		Not delivered yet	Not done yet
Camera	FLIR Duo R		Not delivered yet	Not done yet
Camera	ZED stereo		Not delivered yet	Not done yet
Camera	RealSense Depth			Not done yet
Computer	Intel NUC1			Done
Computer	Intel NUC2			Done
Computer	NVIDIA TX2			Not done yet
Sub-device	Wifi router			Done
Sub-device	Laser distance			Done
Battery	Large1			Done
Battery	Large2			Done
Battery	Payload silver			Done
Solid	Tripod			Done
Solid	Chair			Done
Solid	Table			Done

Task 2. Implementation of Waypoint Following

Implementation of Waypoint Following (1/4)

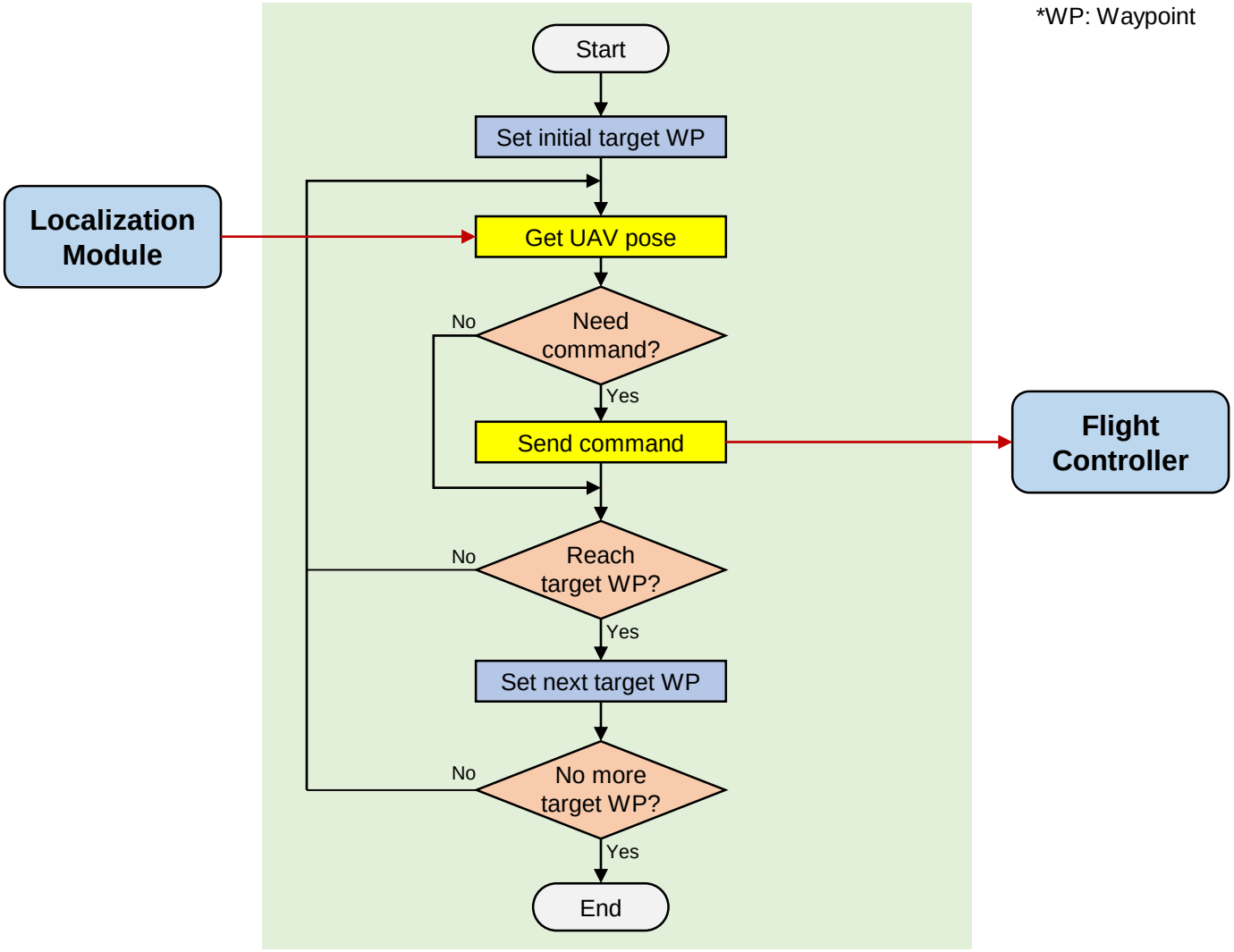
- Objectives

  Implementation of waypoint following, where the waypoints are given by users in advance.



Implementation of Waypoint Following (2/4)

❑ Procedure for Waypoint Following



Implementation of Waypoint Following (3/4)

❑ Plan

Category	Task	Week 1	Week 2	Week 3	Week 4
UWB	Implementing outlier removal in C++/ROS				
UWB-aided Localization	Non-linear optimization in C++/ROS				
	Validation using Oshawa dataset				
	Validation by real experiment				
Mission Runner	Implementing mission runner in C++/ROS				
	Validation by simulation				
	Validation by real experiment				

Implementation of Waypoint Following (4/4)

❑ References

- DJI official1 - void Control::positionAndYawCtrl(float32_t x, float32_t y, float32_t z, float32_t yaw)
  https://developer.dji.com/onboard-api-reference/index.html
  https://developer.dji.com/onboard-api-reference/classDJI_1_1OSDK_1_1Control.html#a6ed4bc74691c3e4fb0d5b30bcb67d6f5

- DJI official2
  https://developer.dji.com/onboard-sdk/documentation/guides/component-guide-missions.html
  https://developer.dji.com/onboard-sdk/documentation/sample-doc/missions.html#output

- DJI Matrice100 control and waypoints following
  https://youtu.be/kBwdWXCKFFI

- Stand-alone waypoint navigator
  https://github.com/ethz-asl/waypoint_navigator

- Interface of DJI autopilot based on its OSDK (3.2)
  https://github.com/ethz-asl/dji_onboard_sdk_ros/wiki/Waypoint-Following

- Building your own DJI M100 drone
  https://discourse.ros.org/t/building-your-own-dji-m100-drone/1272