Perception and Navigation for Autonomous Rotorcraft

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Outline:

1. Introduction
2. Rotorcraft Autonomy
3. Experiments
4. Conclusion

Quadrotor Rotorcraft

Advantages:

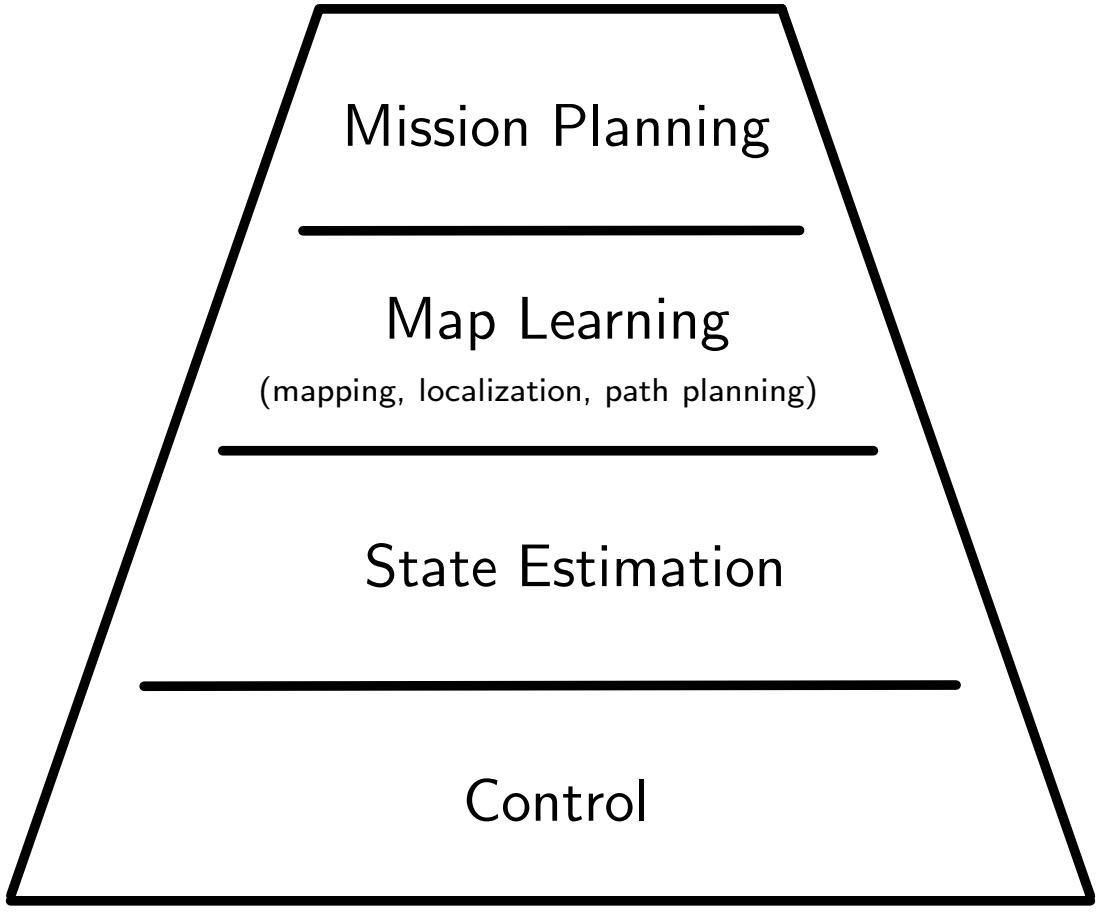
- Maneuverability
- Vantage Point

Applications:

- Fast First-responder
- Monitoring
- Surveillance

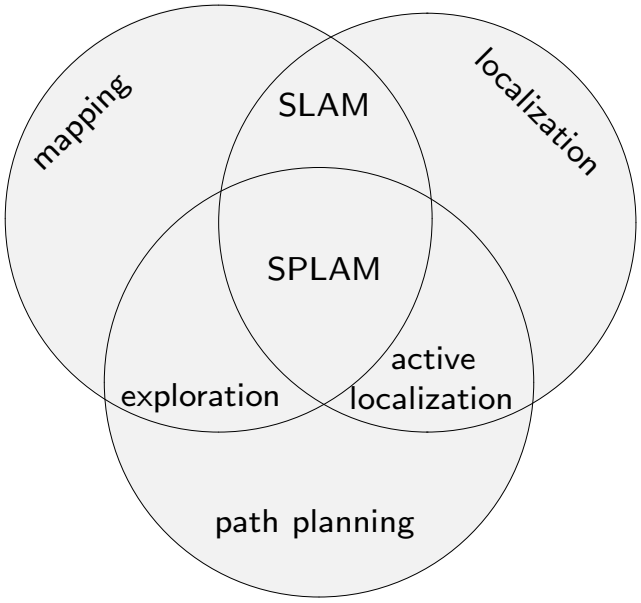
Problems:

- Nonlinear and Fast Dynamics and Vibration Effects
- Limited Payload
- Odometry Limitation
- Perception
- Navigation



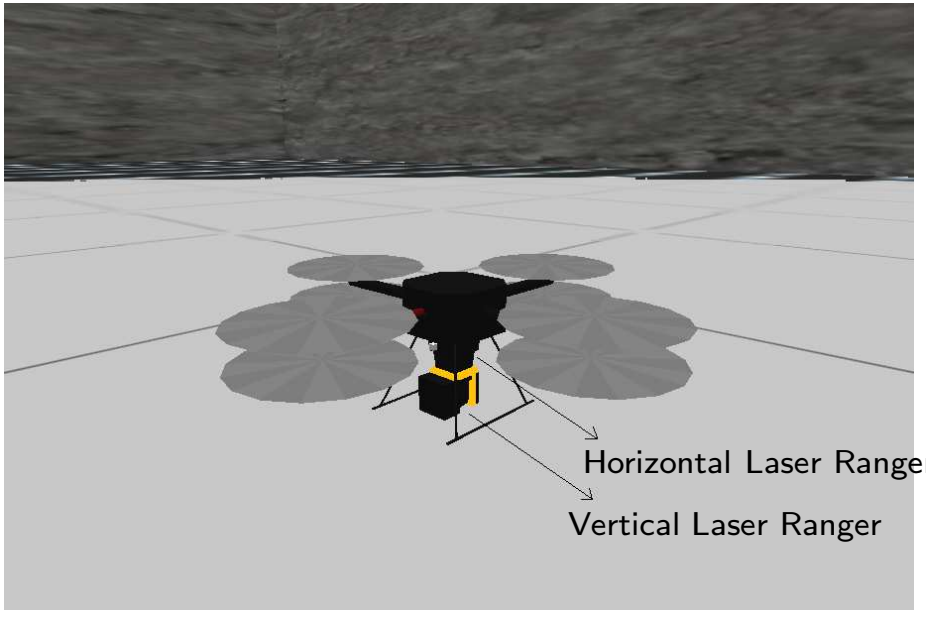
Required tasks to accomplish navigation. Each level relies on information received from the next higher level.

Autonomous Navigation

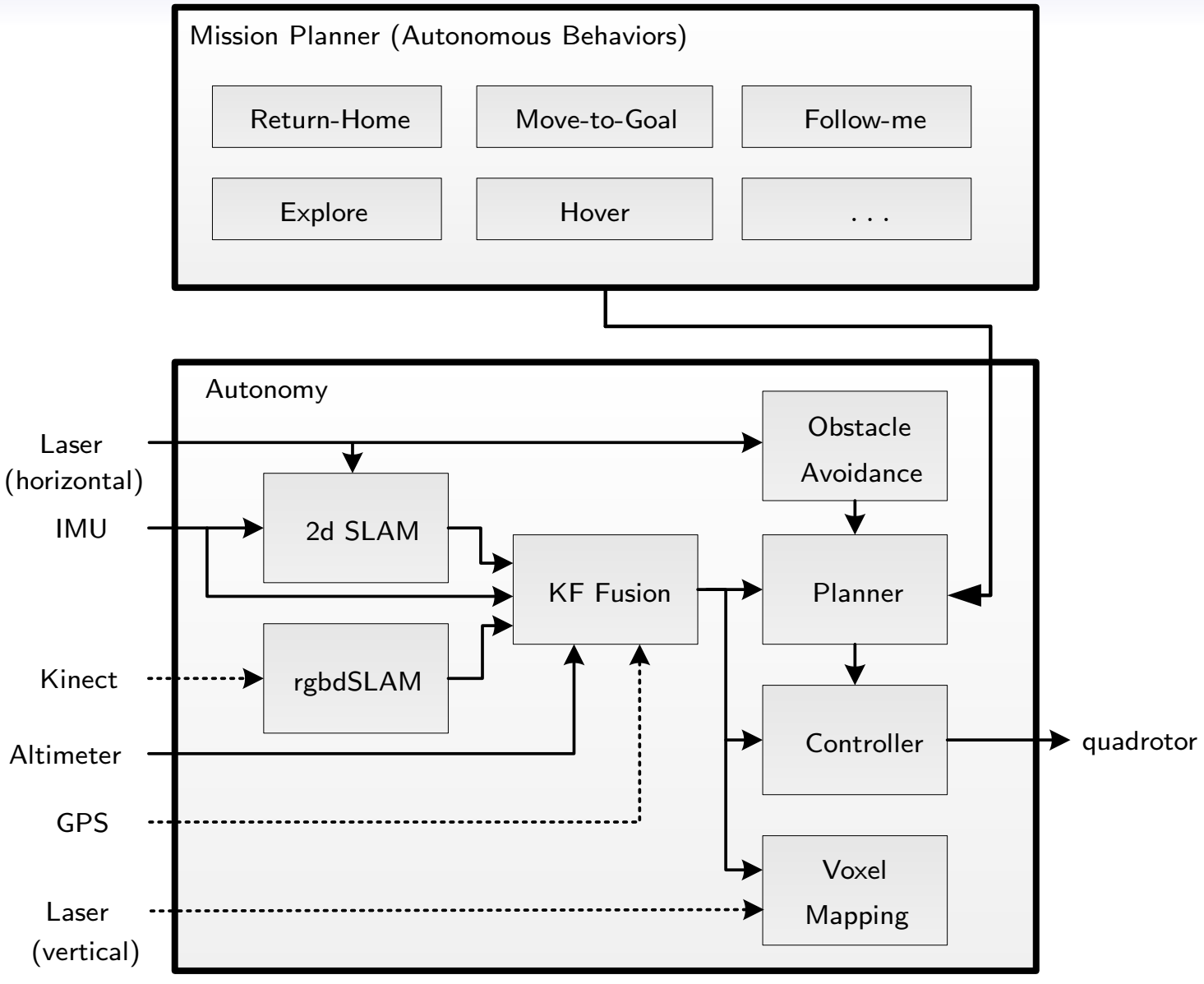


Tasks that need to be accomplished towards map learning.

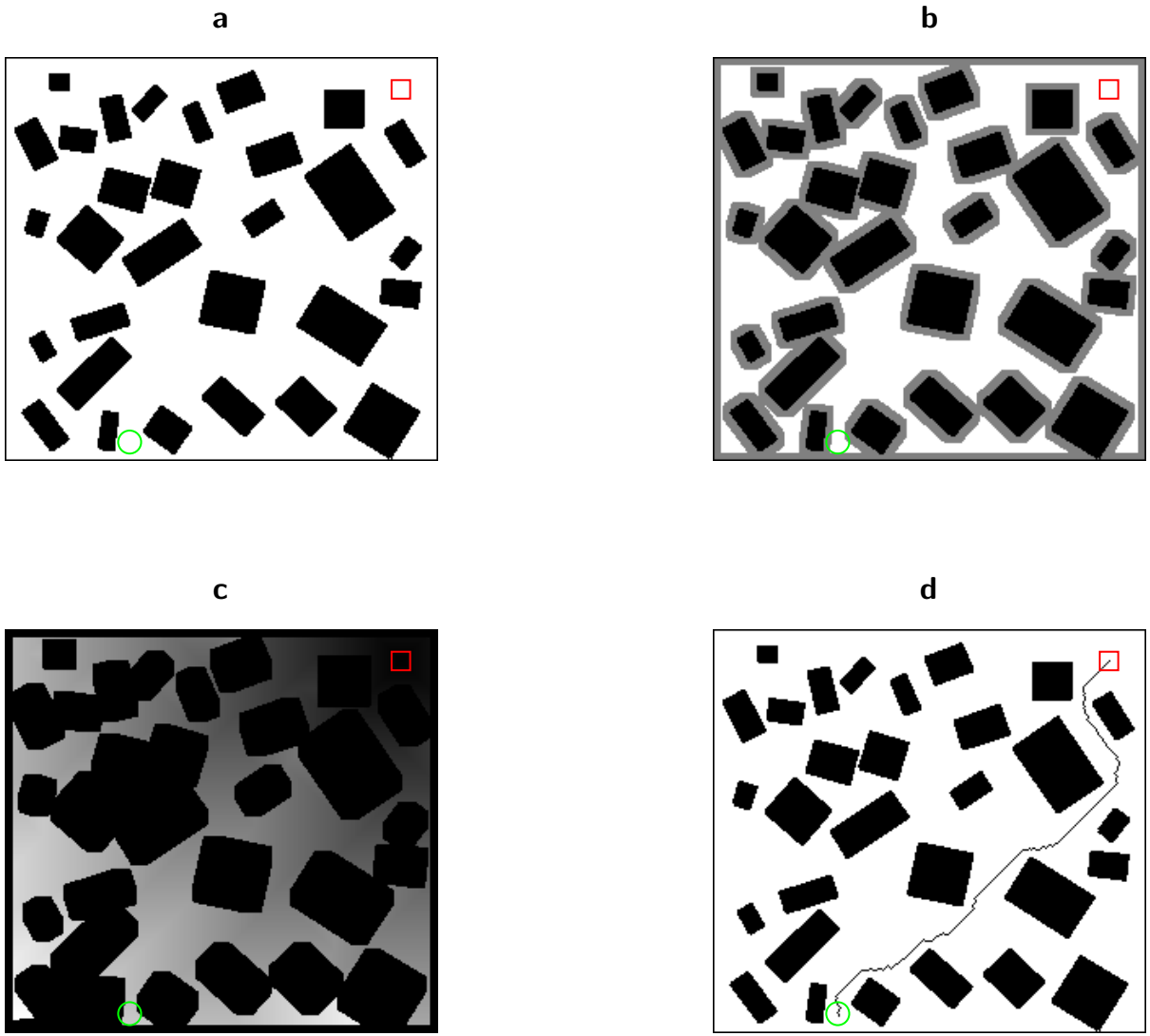
COBRA quadrotor



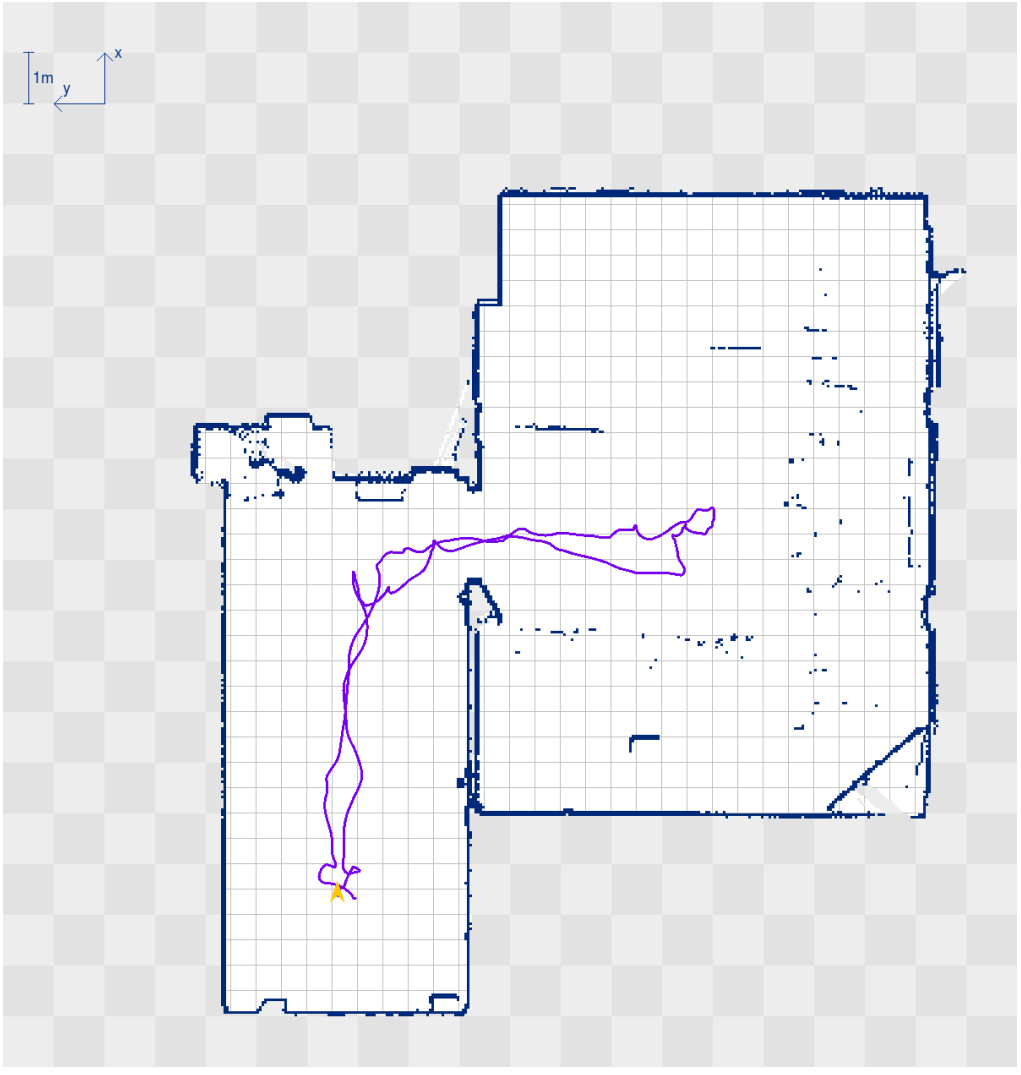
Simulated quadrotor



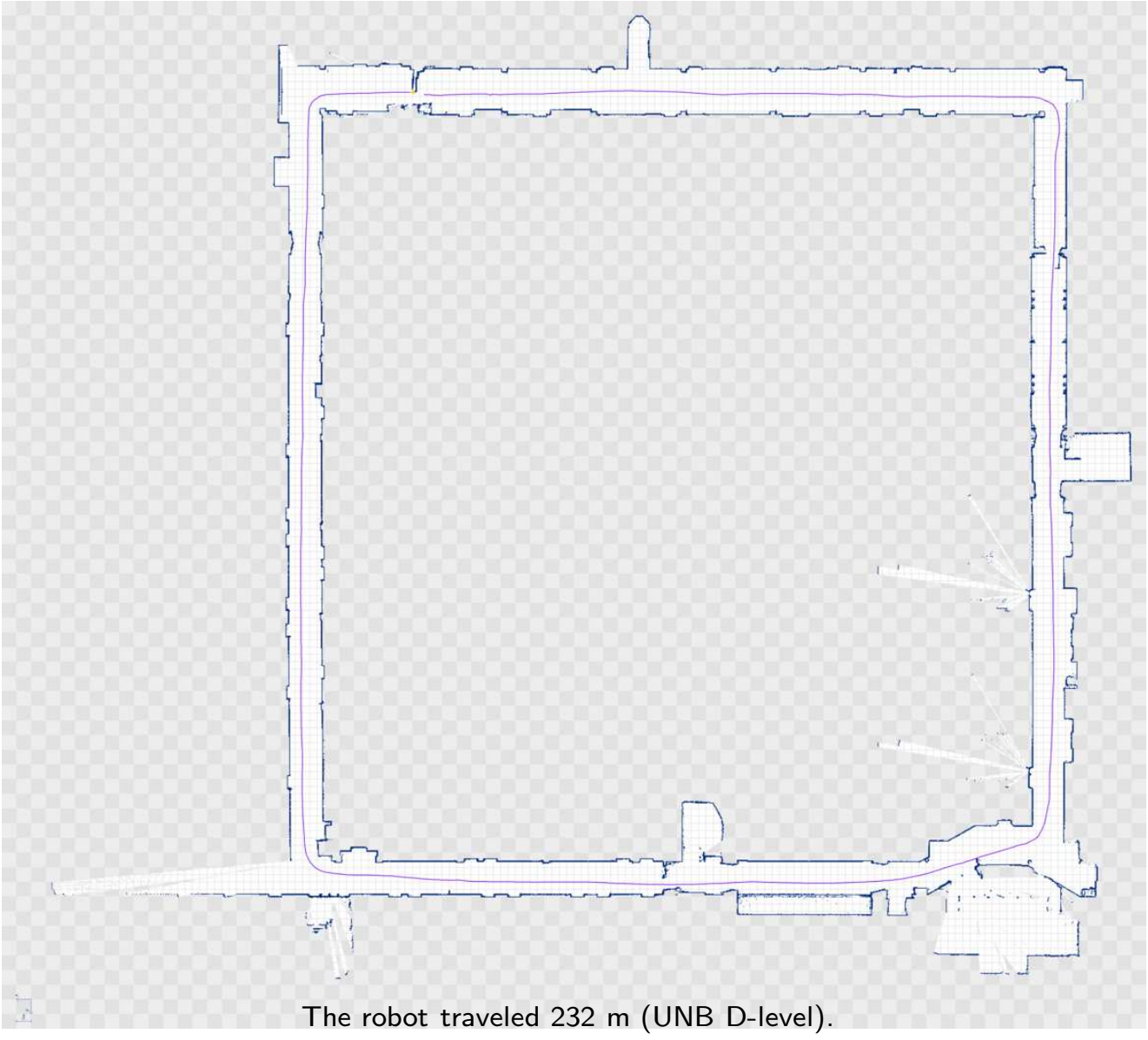
Proposed perception and autonomous navigation.



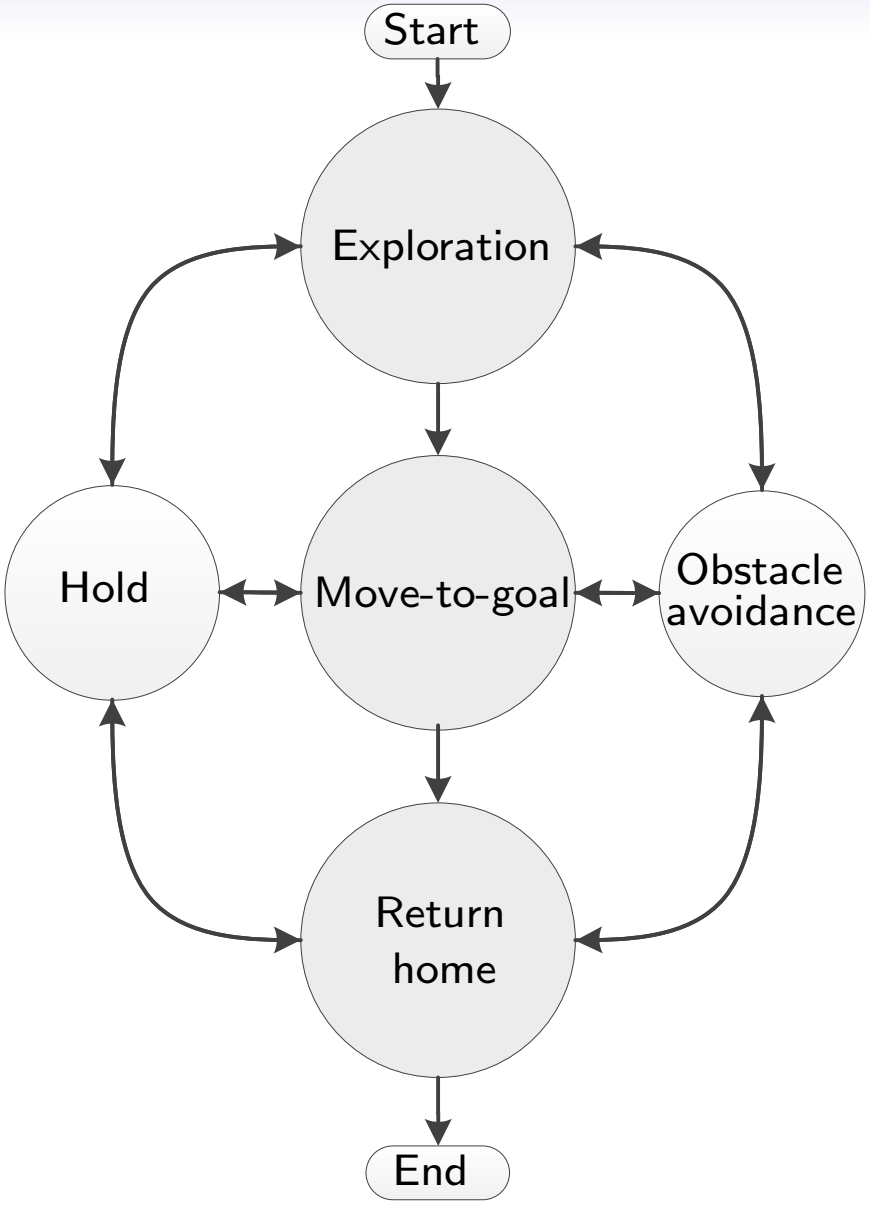
An example of the wavefront algorithm. **a)** A simulated environment. **b)** Obstacles are dilated. **c)** A wave is generated. **d)** A path is designed.



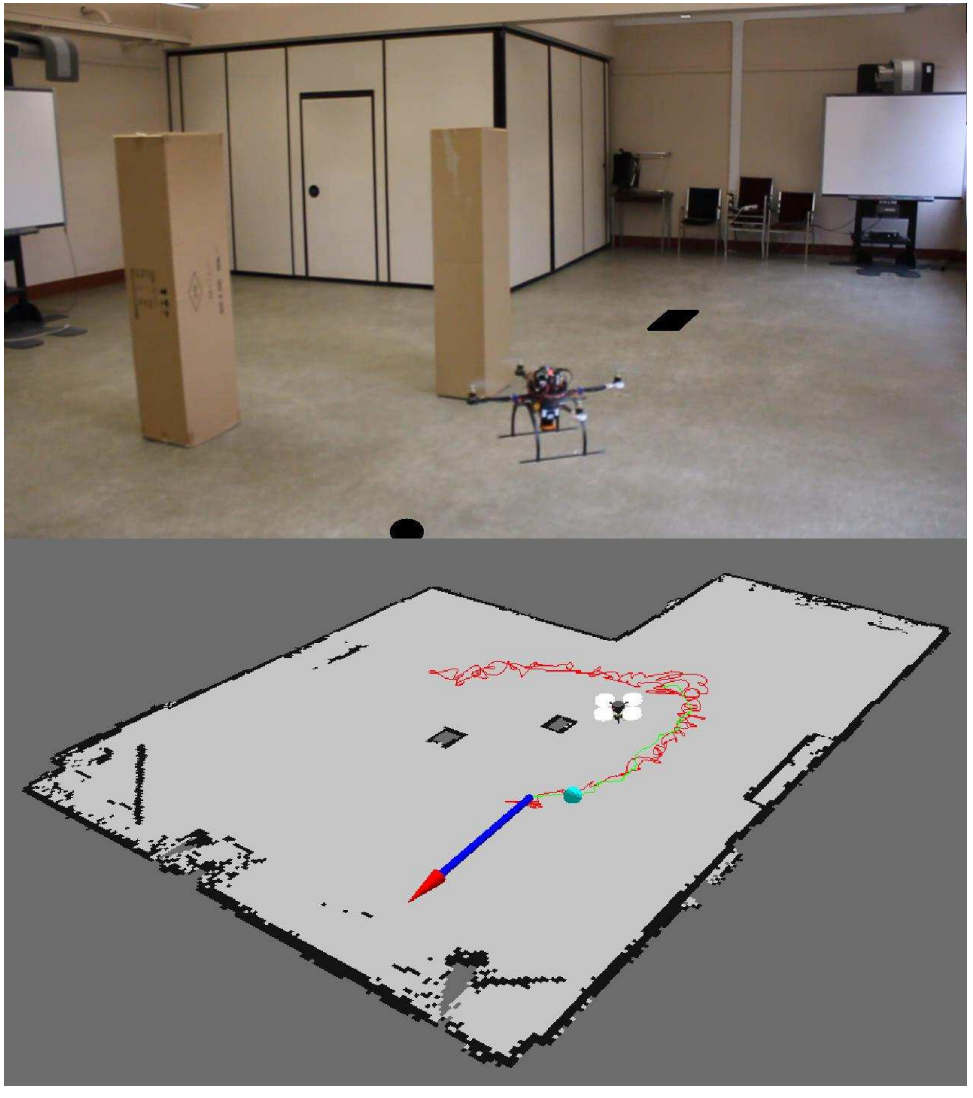
Mapping with COBRA quadrotor. The quadrotor traveled 35 m (UNB H302).



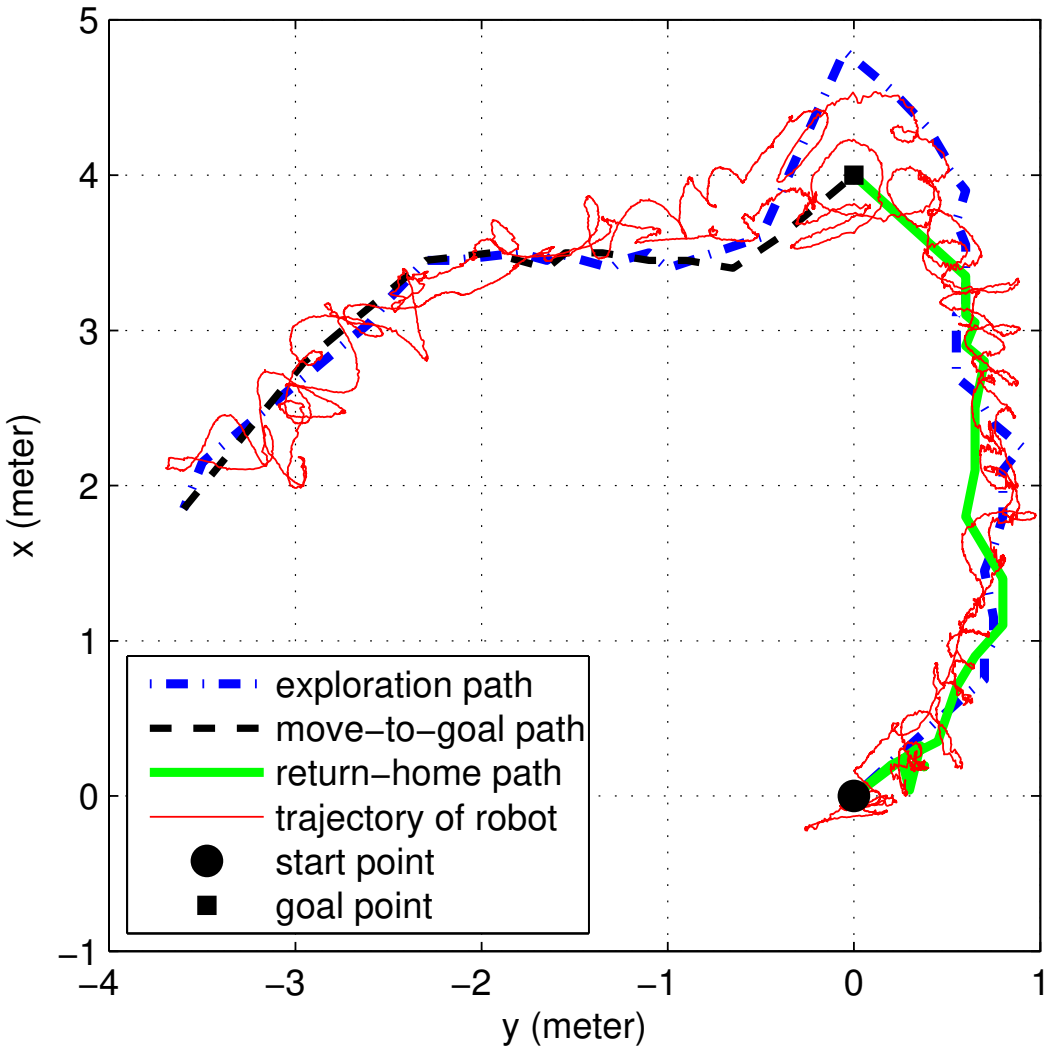
The robot traveled 232 m (UNB D-level).



A sample mission composed of basic navigation behaviors.

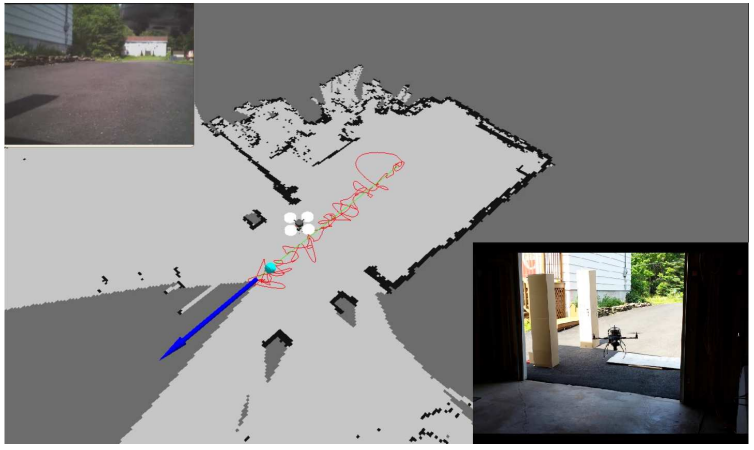


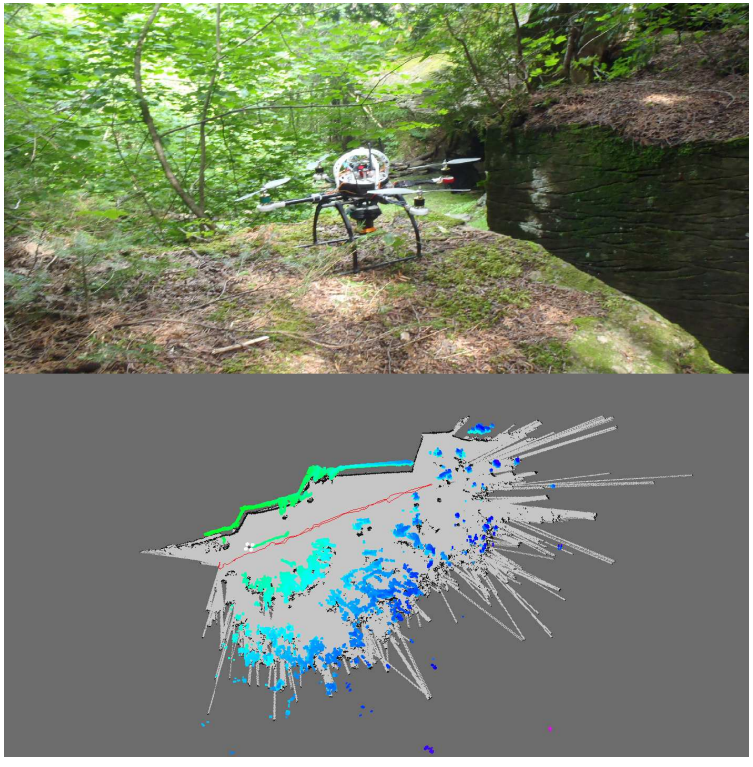
Experiment with COBRA quadrotor. **a)** The test environment. **b)** The developed map and trajectory of the robot.

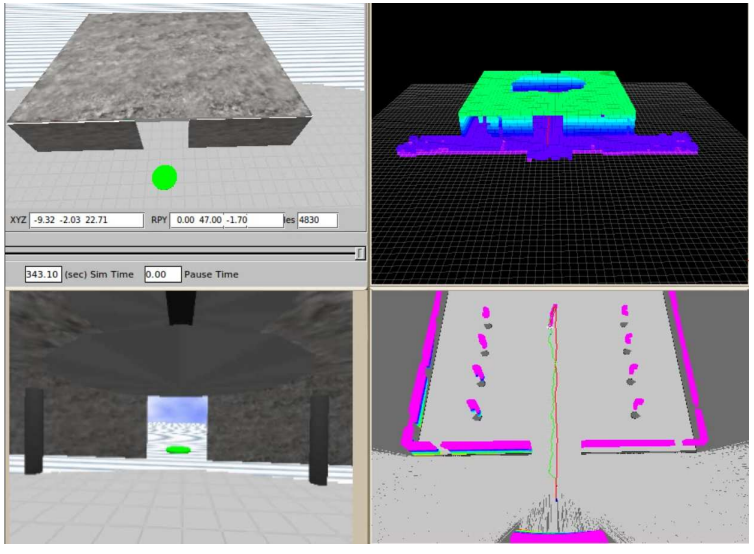

5
4
3
2
1
0
−1
−4
−3
−2
−1
0
1
x (meter)
y (meter)
exploration path
move−to−goal path
return−home path
trajectory of robot
start point
goal point

Other Experiments:

- Simulation in ROS/Gazebo
- Unamend Ground Vehicle
- DraganFlyer X8
- Quadrotor in an Indoor Environment
- Autonomous Entry and Exit
- Outdoor Unstructured Environment







Rotorcraft Autonomy:

- SLAM
- Path Planning
- Exploration
- Autonomous Behaviors

Future Work:

- Multiple quadrotors
- More Behaviours
- 3D navigation

Thank You.