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

Horizontal Laser Ranger

Vertical Laser Ranger
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.
Introduction

Rotorcraft SLAM Experiments Conclusion

-4 -3 -2 -1 0 1

y (meter)

x (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.