Xlim Axe SRI

Collaborative completion of hybrid maps *for air-ground localization and navigation*

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Context and Problematic

Drones & Rovers

Air-Ground cooperation has attracted many research, mainly due to the complementarity of these systems.
UAV → High agility and large field of view. Low payload and limited time of flight.
Rover→ High payload and long term missions. Constrained mobility and limited perception

Cooperation

The different point of view given by heterogeneous systems allows ground navigation monitored from aerial sensors.

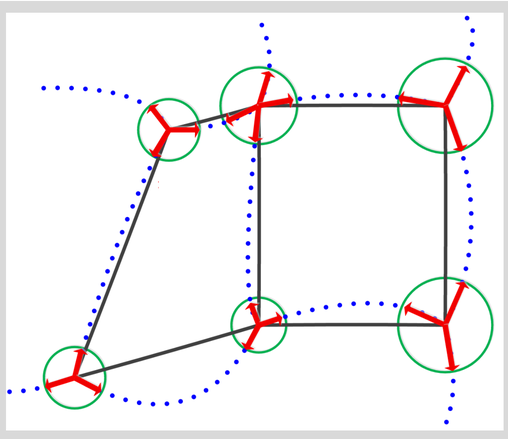
How to use ground and aerial robots to compute a map for ground navigation using information from both view points ?

Approach

Hybrid graphs

Graph:
- Nodes = junctions
- Edges = roads

topo/geometric Information:
- Node radius
- Edges trajectory
- Incident angles

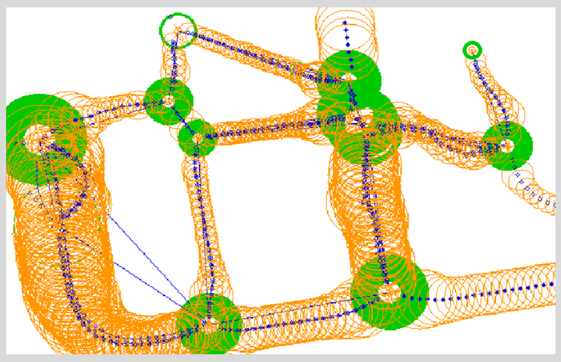


Advantages
- Focus on useful information for navigation
- Path planning can be done easily
- Can be applied on large areas
- Can carry other information (GPS, Semantic)

Limits
- Need structured environments

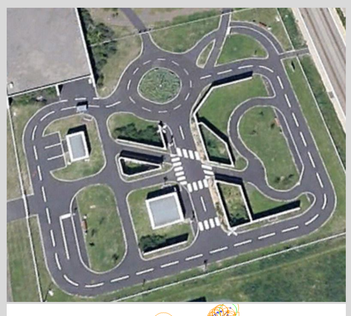
Ground

Sensors:
Lidar
Omnidirectional camera



Mapping process:
Exploration using the camera for na vigation and map local freespace

Air

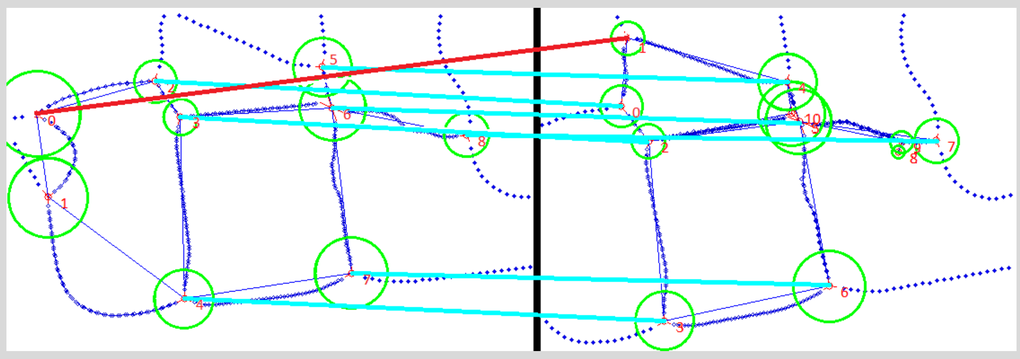


Sensors:
Downward camera
GPS
IMU

Mapping process:
Create map from the traversability extracted from the images

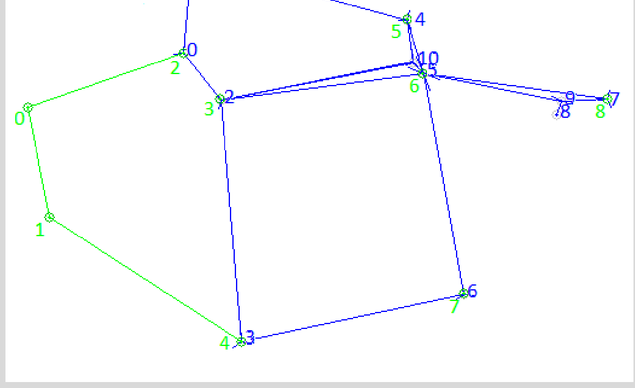
Matching and completion

Node-based graph matching with topologic constraints



Matching in 2 steps:
1. Based on nodes descriptor
2. Based on nodes position

Robust Completion:
- RANSAC outliers rejection
- Data Aging process



Conclusion and perspectives

This algorithm was validated in simulation and real experiments, large scale need to be tested
This approach can be extended to a swarm of robots
This method can be upgraded using visual features and GPS