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Cooperative Tracking and Landing of Unmanned Aerial Vehicle on a Mobile Platform

Cooperative Robotics

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Outline

- Introduction
- Overall Architecture
- Experiments
- Results
- Conclusions

Introduction

Overall Architecture

Experiments

Results

Conclusions

Introduction

- Motivations

- Growing interest in developing unmanned aircraft system
- Applications – delivery drones, search and rescue, aerial photography
- Key challenges:
  - Landing the drone on a mobile platform
  - Robustness
  - Safety
  - Real-time cooperation

Introduction

Overall Architecture

Experiments

Results

Conclusions

Introduction

- Robots used

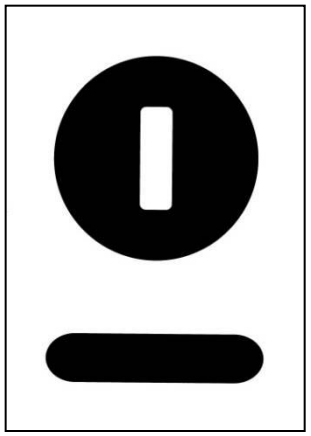
- Parrot AR Drone 2.0
- TurtleBot 2

- Cooperation

- Direct cooperation: message exchange
- Indirect cooperation: tag tracking

- Protocol subtasks

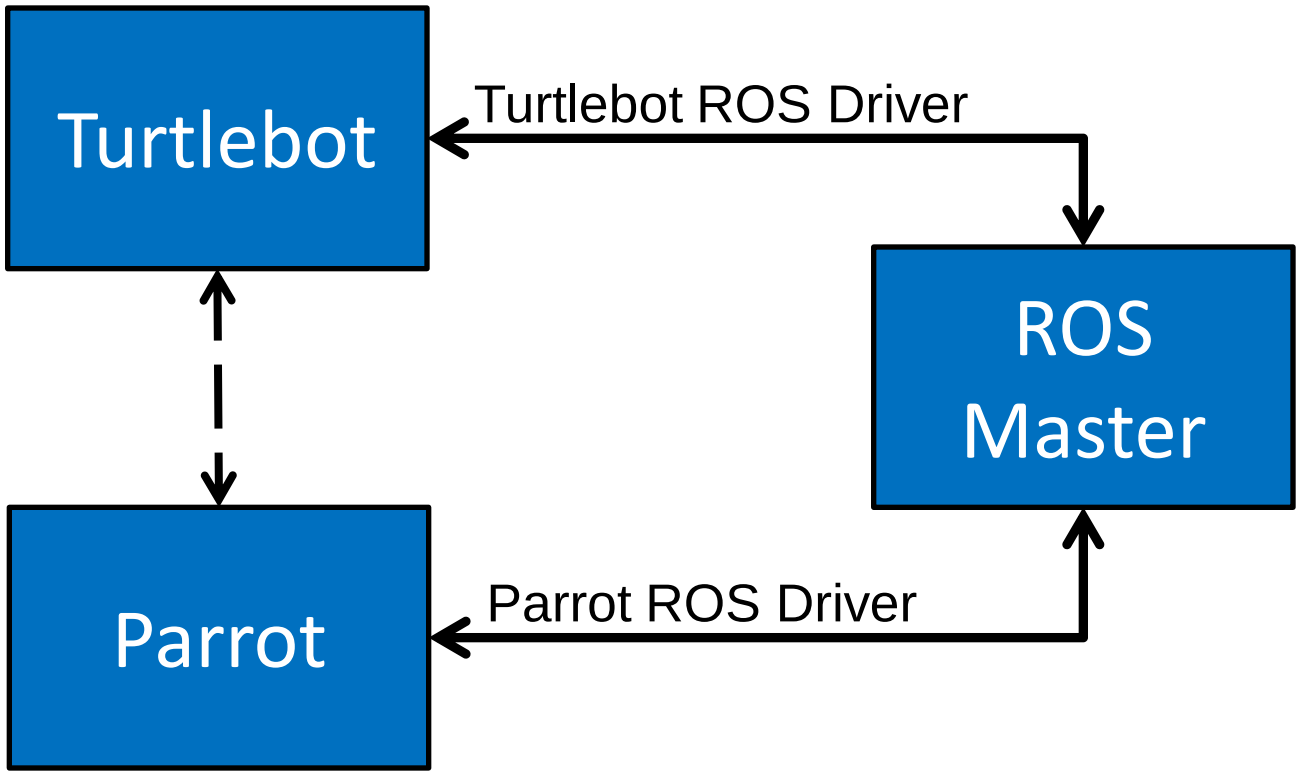
- Taking off
- Tracking
- Landing



Introduction
Overall Architecture
Experiments
Results
Conclusions

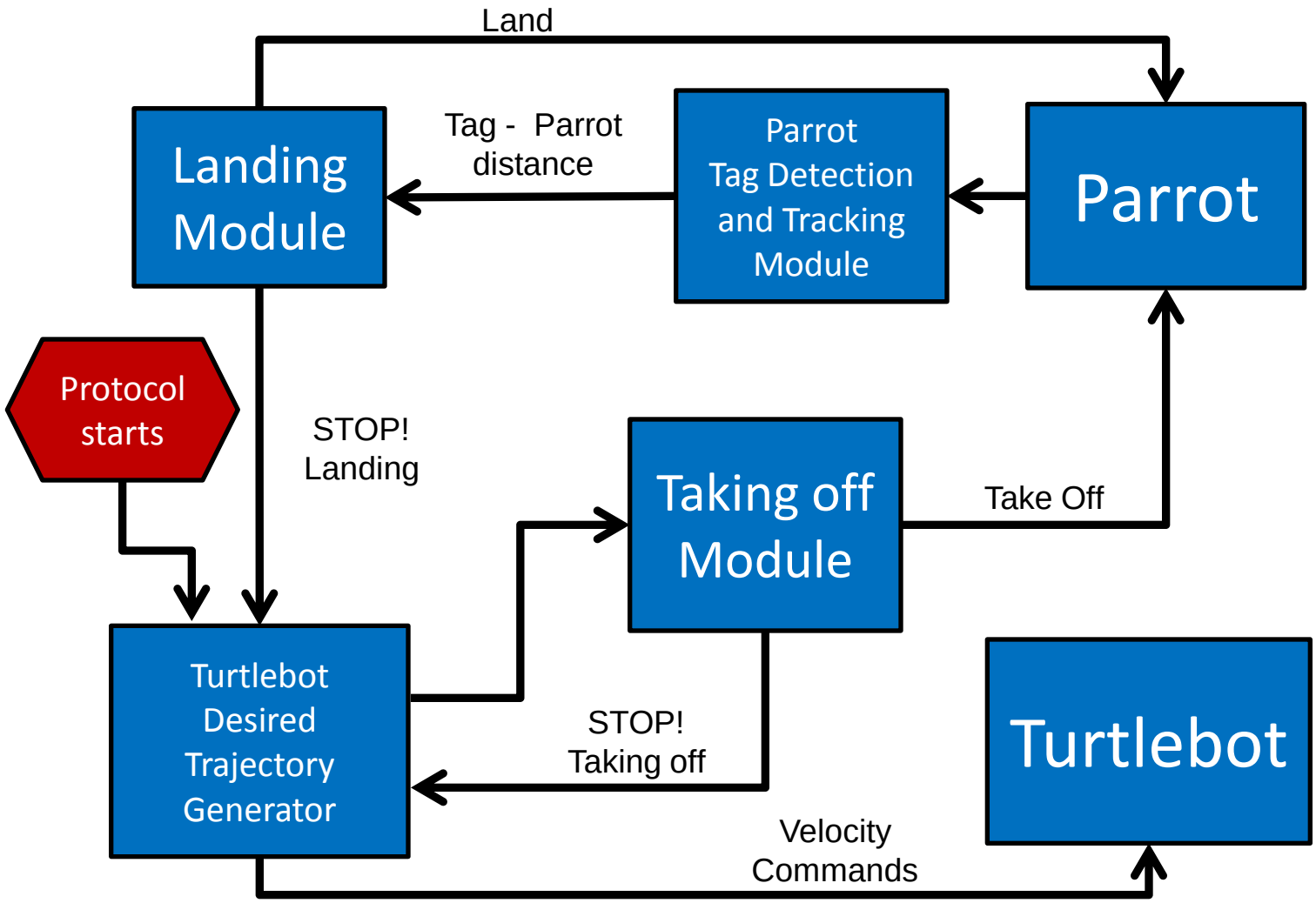
Overall Architecture

- Use of ROS framework



Introduction
Overall Architecture
Experiments
Results
Conclusions

Overall Architecture



Introduction

Overall Architecture

Experiments

Results

Conclusions

Experiments

- Protocol: immediate tag detection

https://youtu.be/7lvlAJ4FWSA

Introduction

Overall Architecture

Experiments

Results

Conclusions

Experiments

- Protocol: search for tag

https://youtu.be/5W9rNap42i4

Introduction

Overall Architecture

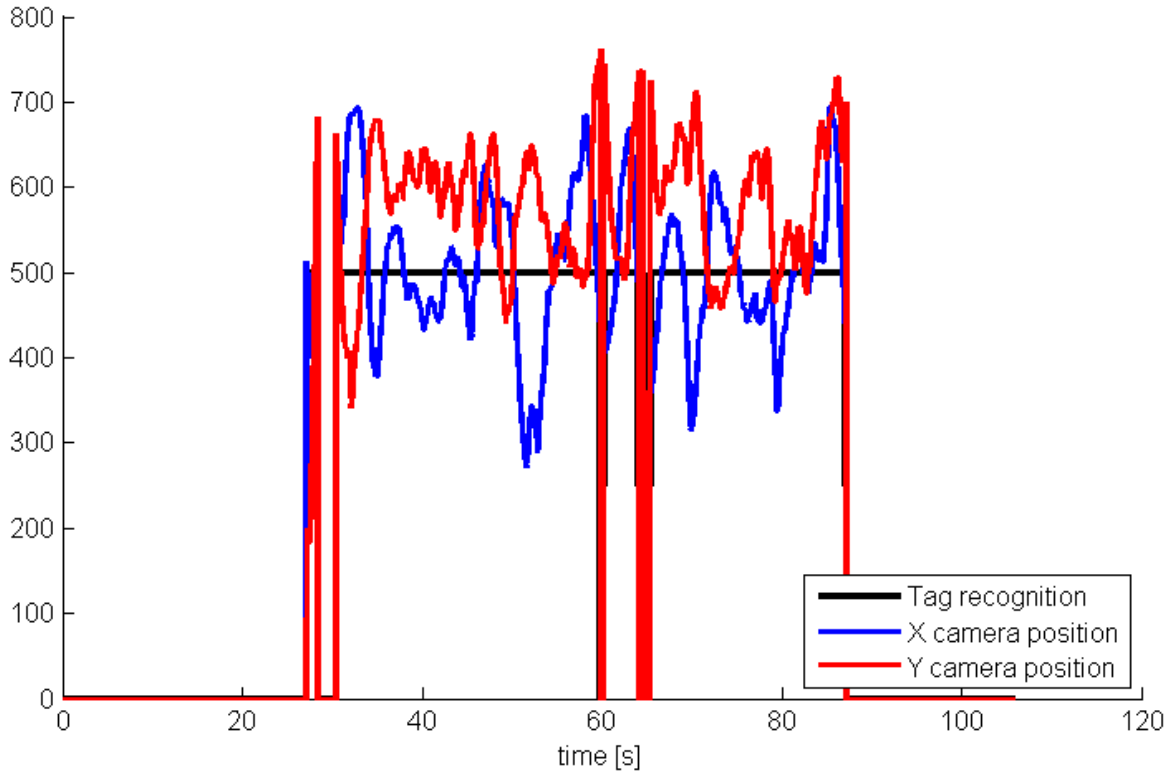
Experiments

Results

Conclusions

Results

- Tag tracking



Introduction

Overall Architecture

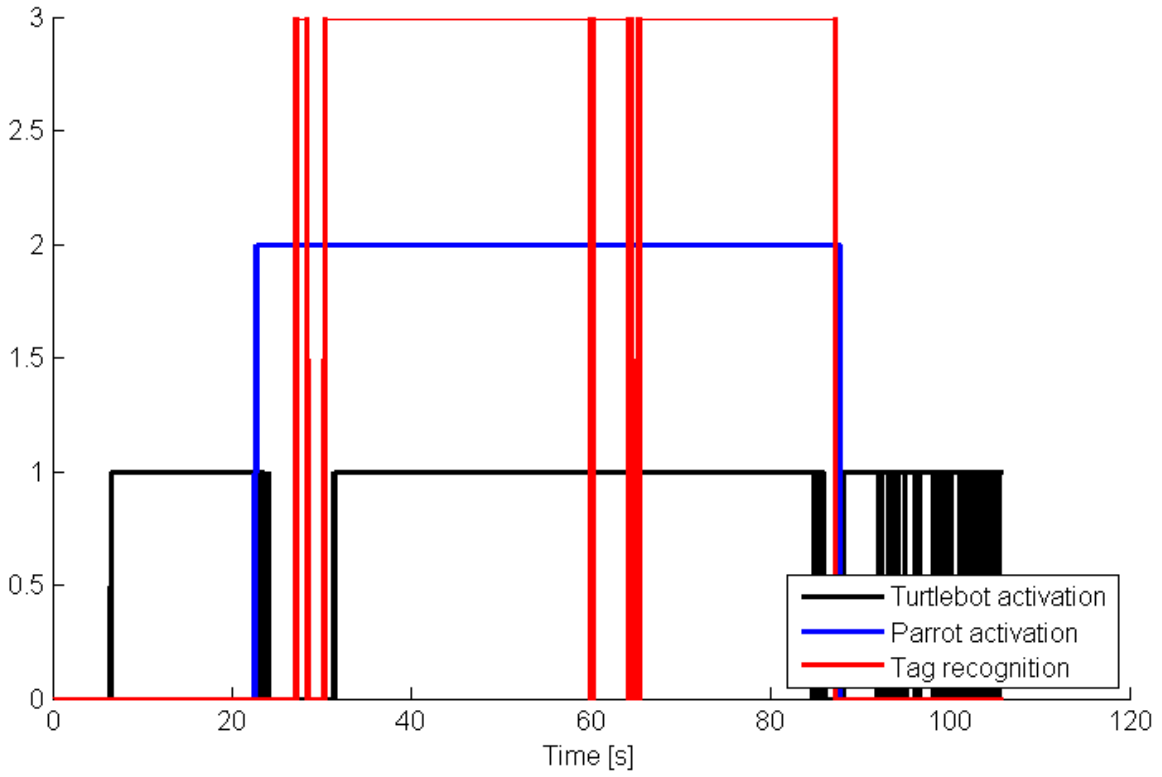
Experiments

Results

Conclusions

Results

- Tag detection and robot motion (1)



Introduction

Overall Architecture

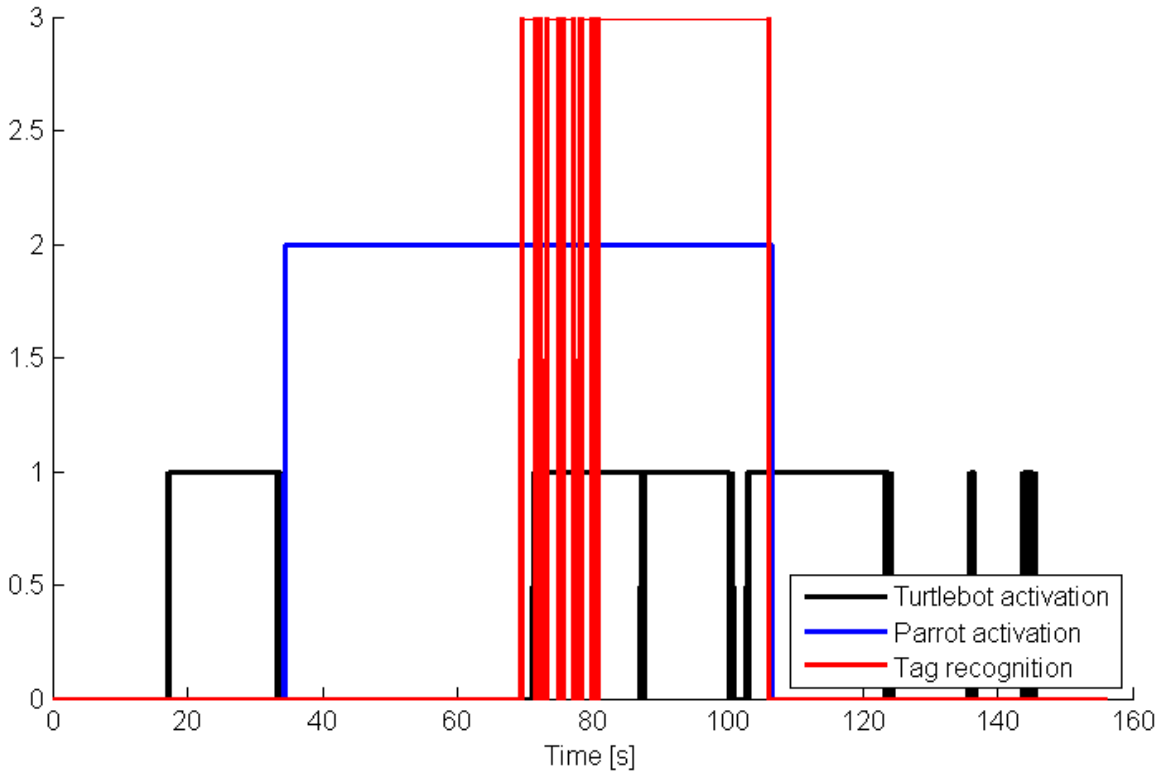
Experiments

Results

Conclusions

Results

- Tag detection and robot motion (2)



Introduction

Overall Architecture

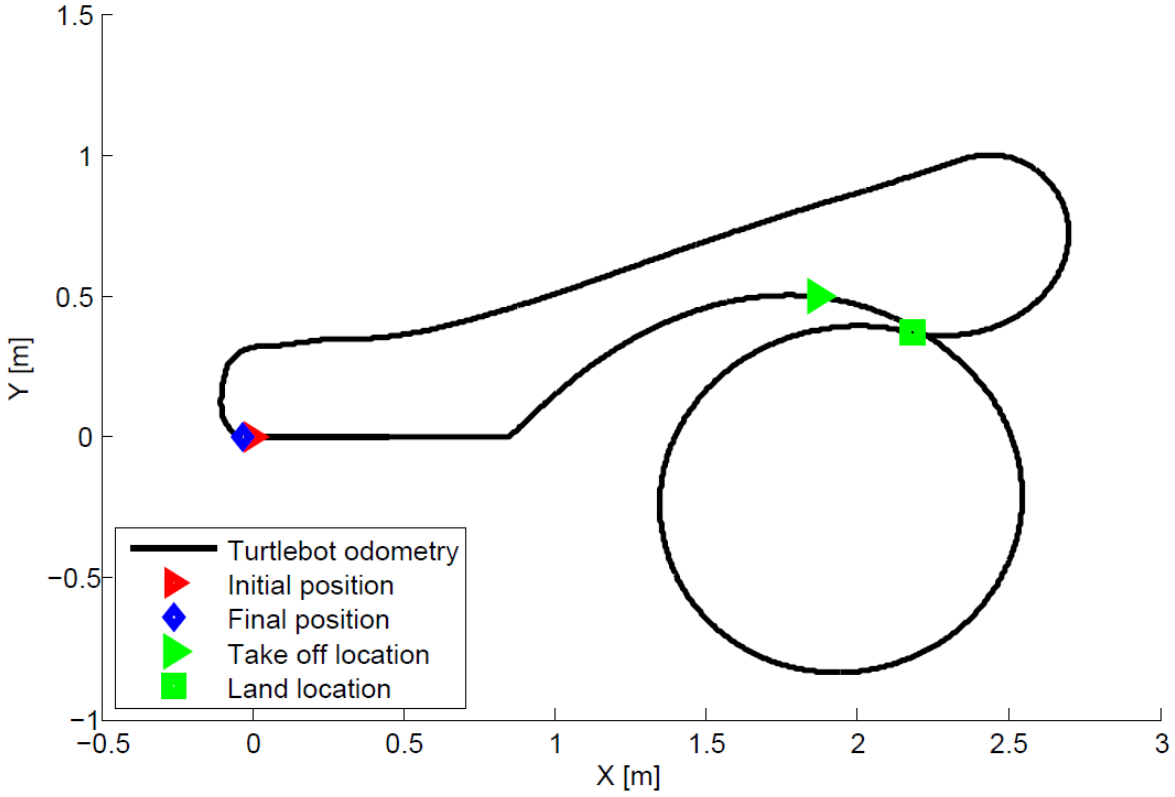
Experiments

Results

Conclusions

Results

- TurtleBot path (odometry)



Introduction
Overall Architecture
Experiments
Results
Conclusions

Conclusions

- Achivements

- Safe take-off / landing
- Robust on-board tracking
- Successful real-time cooperation

- Issues

- Low-resolution bottom camera
- Undesired drifts

- Future works

- Use of State Estimation (Kalman filter)

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THANK YOU FOR YOUR ATTENTION!

(Question time)

Detailed documentation:

https://github.com/emanuelesansebastiano/move_coop_pkg

https://youtu.be/7lvlAJ4FWSA

https://youtu.be/5W9rNap42i4

https://youtu.be/TKSGK9J5FgQ

Introduction

VDC Explanation

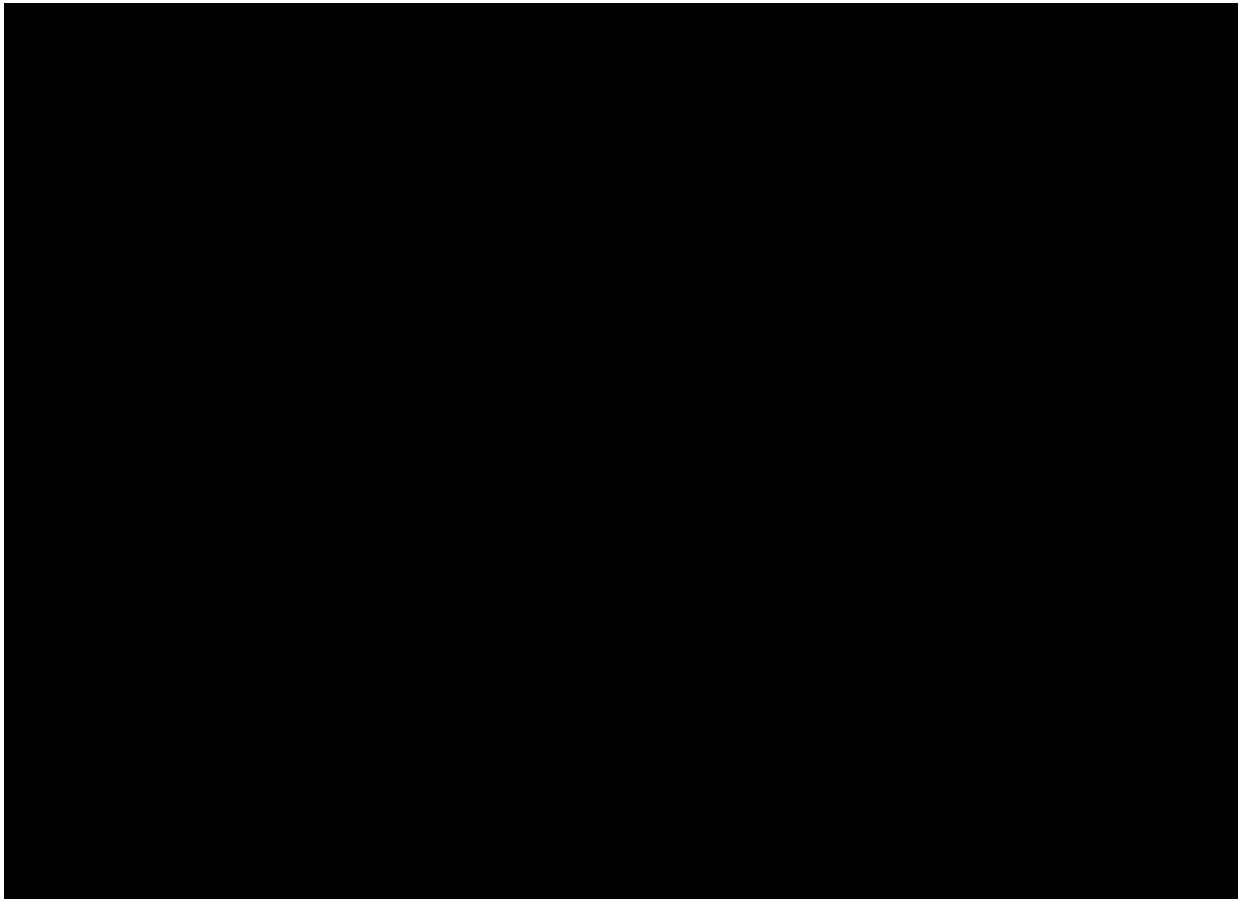
Results

Issues

Conclusions

Extra

- **Drone drifting**



Introduction

VDC Explanation

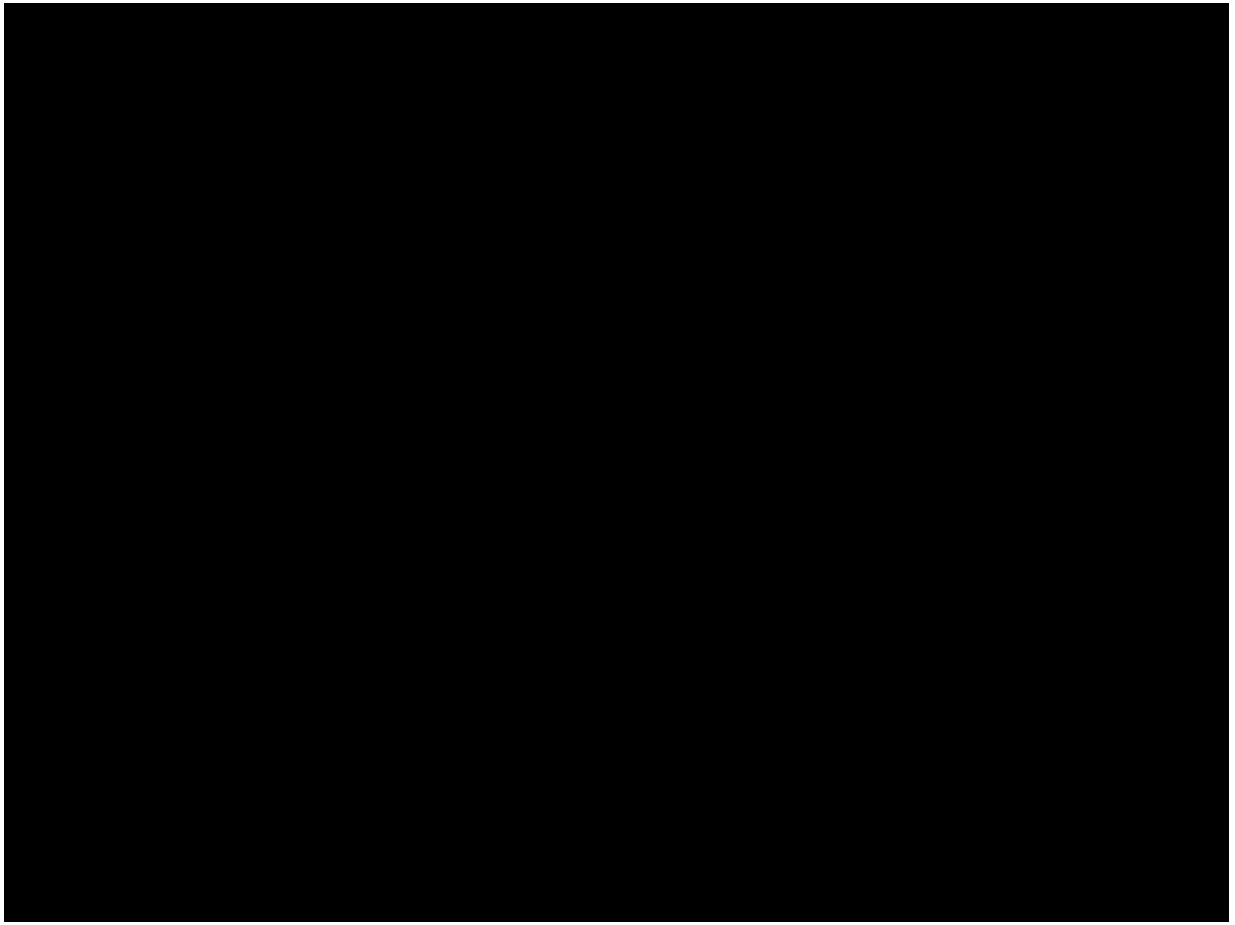
Results

Issues

Conclusions

Extra

- Drone stuck after taking off



Introduction

VDC Explanation

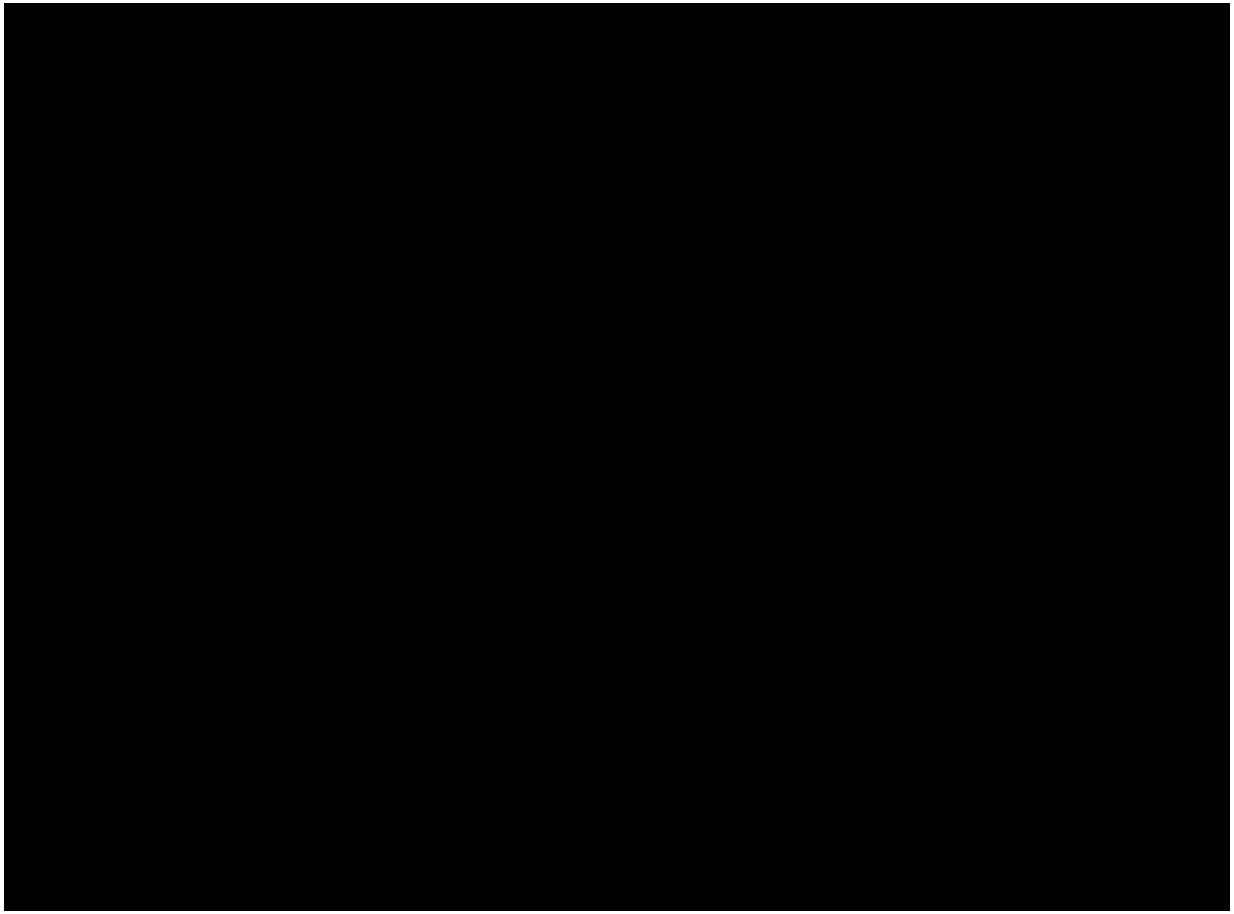
Results

Issues

Conclusions

Extra

- Takeoff module – no tag



Introduction

VDC Explanation

Results

Issues

Conclusions

Extra

- Landing module

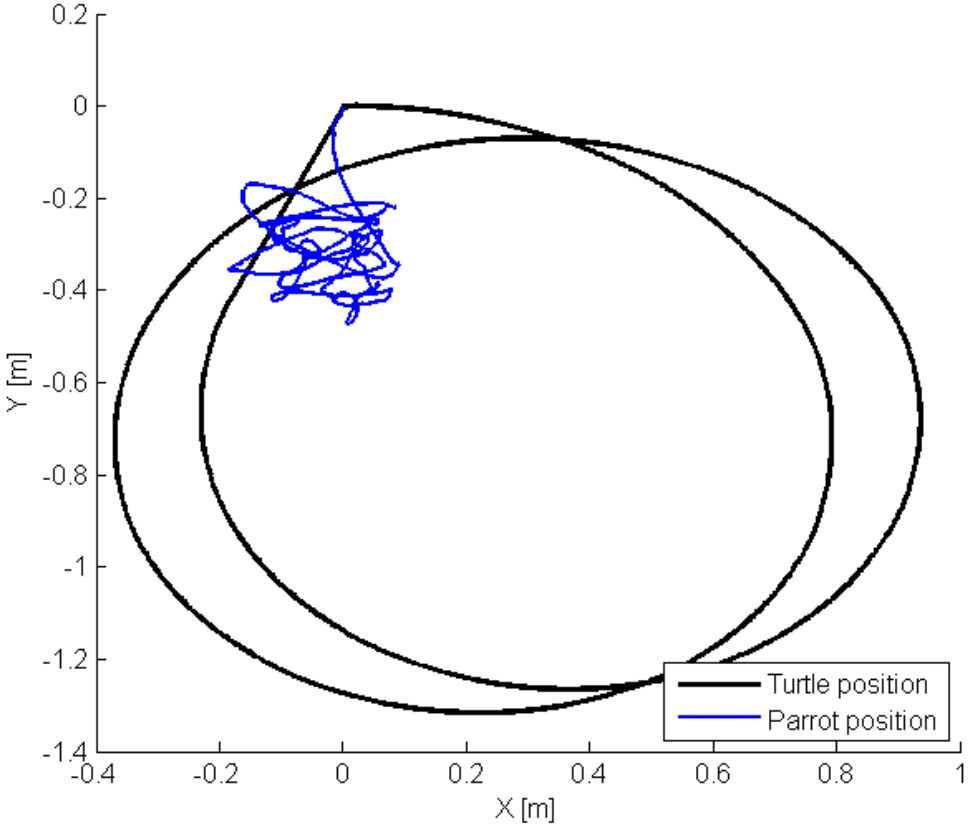
Introduction

VDC Explanation

Results

Issues

Conclusions

Extra

- Drone & TurtleBot odometry