Camera Drones
Lecture 1 – Camera drones overview

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WS 2020
About me

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- Sprechstunde nach Vereinbarung
Course schedule

- See dates for lecture slots in TUG-Online (lectures will be recorded videos, live Q&A sessions will be offered)

- Project work
  - Drone navigation practical
  - Presentation
  - Documentation

- Course grade will be based on the grades for the project work including documentation, project presentation and a questionnaire (60/10/30).

- Start of project work leads to grading of the course

- The project work is the partial course assignment that can be repeated or supplemented
Course schedule

- Lecture topics:
  - Quadrotor Basics
  - Control and Sensors
  - 3D Data generation (SFM, dense matching)
  - Visual Odometry
  - Flight planning for 3D reconstruction
  - Drone regulations in Austria

- Hands-on-ROS tutorial (video recording)
- Quiz (13.01.2021)
- Final presentations (20.1.2021/27.1.2021)
Practical part of the course
Course drone

- A drone based on the Bebop 2 frame (32x38cm) with Pixhawk flight controller
Course drone

- Equipped with Odroid UX4 board and depth camera.
Course drone components
Lab infrastructure (droneSpace)
Tracking cameras
Practical 2020 – Collision free navigation
Practical 2020 - Collision free navigation

Main tasks:

- 1. Mapping of the environment
  - Create Octomap from sensor input such that it provides a 3D map for path planning.

- 2. Path planning for safe navigation
  - Implement a path planning algorithm to navigate the drone collision-free to a goal position (e.g. RRT algorithm)

- 3. Trajectory generation and flight
  - Perform flight and videotape it
Task 1: Mapping of the environment

- Octomap creation from ROS-Bag
Task 2: Path planning
Task 3: Trajectory generation and flight

MAV trajectory generation
- Smooth trajectory from path
- Impose position derivatives (speed, acceleration, jerk, snap)
Camera drones overview
Camera drones overview

- Consumer drones

- Professional drones

- Research drones
Consumer drones – The First

[Image credit: Parrot]
Consumer drones

[Image credit: DJI]

[Image credit: Yuneec]

[Image credit: GoPro]

[Image credit: Parrot]
Consumer drones

- Sykdio R1

[Image credit: Skydio]
Professional drones

- Asctec Falcon
- Aerial photography and inspection

[Image credit: Asctec]
Professional drones

- Leica/Aibotix drone
- Inspection and measurement tasks
Professional drones

- Riegl Ricopter
- Photogrammetry and Laser scanning
- 25kg!
Professional drones

- Flyability drone
- Indoor inspection
Professional drones

- Honeywell RQ-16 T-Hawk
- Reconnaissance, long endurance drone

[Image credit: Wikipedia]
Professional drones

- Schiebel Camcopter
- Industrial inspection, long endurance drone

[Image credit: By User:Stahlkocher, CC BY-SA 3.0]
Professional drones

- Sensefly Ebee
- Fixed wing, long endurance
- Photogrammetry

[Image credit: Sensefly]
Professional drones

- Swarmsys Nano-Drone
- Reconnaissance

[Image credit: Swarmsys]
Research drone

- Pixhawk drone
- Modular research platform with onboard computer and cameras
Research drone

- Asctec Firefly
- Modular research platform with onboard computer and cameras
Research drone

- DJI Matrice 100
- Modular research platform with onboard computer and cameras
- Onboard stereo depth sensors
Camera drone applications and research

- Action filming
- Archeology ([3D Pitoti, 3D Model](#))
- Inspection (Bridges, Power pylons)
- Search and Rescue ([DJI Challenge](#))
- Agriculture
- Safe navigation ([Video](#))
- Autonomous exploration ([Video](#))
- Human-Robot Interaction ([Video](#))
- Delivery ([Video](#))
- Industrial application ([Video](#))
Past student projects

- "Don’t Throw Things At Drones!“
- "Optitrack & RGBD-Sensor Based Indoor Mapping“
- "Hand-Gesture Based Drone Control“
- "Visual Marker Following Drone“
- "Hula Hoop Following Drone“
- "ORB2 SLAM Based Indoor Reconstruction“
- "Snapdragon Flight Based Object Recognition And Waypoint Following"