

Institute of Networked and Embedded Systems

Autonomous Networked µDrones

Univ.-Prof. Dr.-Ing. **Christian Bettstetter** Talk at Inst. of Communication Networks, TUM, Dec 2012

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Small Unmanned Aerial Vehicle (UAV)



AscTec Pelican

Types of UAVs





AscTec Hummingbird



Parrot AR.Drone



Microdrones GmbH

Gatewing X100



AscTec Falcon

- Quadrocopter, octocopter, fixed wing
- Indoor, outdoor
- Commercial, research platforms, toys
- From 200 € to 30.000 € and above

Various Applications, Biz Opportunities





3D mapping

Person and object tracking

Industrial site monitoring, police support, accident documentation, and many others

Small UAVs perform "James Bond theme"



Work by U Penn, 2012, with 3.3 Million hits on YouTube

Formation Flight at Cultural Event



Voestalpine Klangwolke, Linz, 2012

Photo with kind permission from C. Lindinger, ARS ELECTRONICA Futurelab, Linz 5



Lakeside Labs – Disaster Management





User defines high-level tasks (e.g. observation area)

User obtains real-time high-quality overview image

Goals and Research Issues

- Develop autonomous system for aerial reconnaissance
- Support first responders in disaster management
- Use off-the-shelf, small-scale, low-altitude multicopters equipped with high-quality cameras and GPS
- Deploy multiple drones to achieve fast area coverage

Research Issues



Challenges

- Strong resource limitations: Flight time, payload, computation
- Coordination of multiple drones: Centralized vs. distributed approach
- Multimedia network with dynamic, three-dimensional mobility
- Non-trivial user interface with prompt response
- Aspects of experimental research: Safety, legal issues
- Aspects of interdisciplinary work



Image Processing: Stitching







Using position data (GPS)

Using position and orientation (GPS and IMU) Exploiting feature detection (Image data)

Apparatus and method for generating an overview image of a plurality of images using an accuracy information. European patent pending, EP2423871 (A1), 2012



Video: Multi-UAV Aerial Imaging



Lakeside Labs

Concluding Remarks

- A mobile, self-organizing networked embedded system
- Challenges due to multidisciplinary and experimental character
- Various applications, several startup companies in Europe
- Attractive for students and PhD researchers



