A Cloud Robotics Based Service for Managing RPAS in Emergency, Rescue and Hazardous Scenarios

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- 25 people Staff

- Research fields
  - Magnetic Suspensions
  - Rotordynamics
  - Control Units for Mechatronics Applications
  - Magnetic Damping Technologies
  - Power and Special Actuators
  - UAVs and UASs
  - Custom Payload and Architectures for UAVs
Agenda

- Mechatronics Lab
- Motivation
- The Cloud Robotics Approach
- RPAS & Cloud
- Application Examples
  - Search and Rescue
  - Imaging Survey
- Conclusion
Motivation

- RPAS need:
  - Switching from piloting to autonomous flight
  - Moving to remote control or management
  - Deal with complex scenarios
  - Manage big amount of data
  - Interact and deploy data to several users

- Cloud robotics and cloud services allow:
  - Switching from “local” to “centralized” intelligence
  - Interact with user at various level
  - Managing different kind of “robots” and services
  - High computational capability and data storage
  - Share knowledge and information
The Cloud Robotics Approach

Cloud Robotics

- Shared approach
- Reliable RPAS
- Reliable architecture
- Low com latencies
- High data bandwidth
RPAS Cloud Architecture: Main Capabilities

- **RPAS monitoring**
  - Real time
  - Missions database and backup
  - Real time video deployment
  - Data collection and deployment
  - Virtual transponder

- **Validated Mission Planning**
  - Including terrain profile
  - Including known “obstacles” and constraints
  - Data fusion with other Database

- **Resources sharing**
  - RPAS status for dynamic mission planning
  - Sensors measurement sharing
Application Examples

- **Search and Rescue (Fly4SmartCity)**
  - Complete automatic Remote Mission
  - RPAS platform independent
  - Final User start the “emergency”
  - Automatic Planning and Validation
  - Live Video&Data streaming with 4G
  - Remote Mission control
  - Multi-client data deployment

- **Imaging Survey**
  - Hybrid Mission (*in situ* RPAS crew)
  - Validate mission is retrieved from cloud
  - Crew manages the “flight”
  - Acquired data are forwarded to cloud
  - Data is checked
Search and Rescue: Fly4SmartCity DEMO

0. Continuous Monitoring

1. “Emergency” Message (App)

2. Coherent Plan
   - Start Mission
   - Monitor Fly
   - Collect Data
   - Update Plan

3. Coordinate teams
   - Deploy Data
   - Share information
   - Get more data

...... additional services
Search and Rescue: Fly4SmartCity
Automated Imaging Survey

1. Crew&RPAS Set-Up
   Local site Check

2. Validate Plan
   Start Mission (crew)
   Monitor Fly (crew&cloud)

3. Data Collection
   Data preliminary validation
Data Processing

- **Data (images&fly-data) are received in cloud**
  - During flight with a proper resolution according communication bandwidth
  - Flight performances is checked
  - Images is checked (overlapping, exposure, incoherencies...)
    → if check is OK crew proceed to the following mission
  - After flight with original resolution for further processing

- **Data processing and Exploiting**
  - Common Automated (Manual) processing
  - Data are available for users
Conclusions

- Architecture and Technologies validated in different scenarios
- RPAS independent
- Rely on 4G or other transmission technologies (up to SAT)
- Automated or Hybrid Remote Controlled
- Allow Data integration in «planning» and «processing»
- Can be customized to several scenarios:
  - S&R and Mapping
  - Disaster Management
  - Patrolling
  - Agricultural
  - Industrial
  - Home Land and Border Security
  - Mountain safety
Thank You

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