Droneport: Autonomous Drone Battery Management

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Project: Comp4Drones

Goal

- provide complete drone framework
- safe & autonomous drones
- customization and modularity for civilian services

Objectives

- easy integration and customization of drone **embedded system**
- safe **autonomous decisions** of drones
- trusted communications
- fast **design and verification** for complex applications
- sustainable impact and creation of an **industry-driven community**

Comp4Drones: 5 Use Cases

Transport

Drones for optimization of transport control, operation and infrastructure management

Construction

Drones for virtual design, construction and operation of transport infrastructures

Logistics

Logistics using heterogeneous drone fleets

Surveillance & Inspection

Drone and wheeled robotic systems for inspection, surveillance and rescue operations

Agriculture

Smart precision agriculture: from drone to rover

UWB task within Comp4Drones

Autonomous Drone Battery Management

- developed by UWB & SmartMotion
- fast reliable system
- essential for long-time missions
- Droneport
- battery swapping

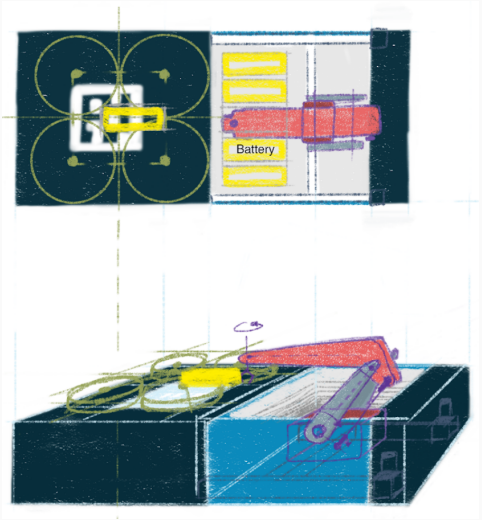
Implementation

- Pixhawk with MAVLink and Rexygen
- Robot Operating System (ROS) & Gazebo

Autonomous Drone Battery Management

Droneport

- marked with ArUco code
  - better localization by drones
  - safer and precise on-spot landing
- drone traffic control
- robotic manipulator for swapping batteries
- battery charging station



Autonomous Drone Battery Management

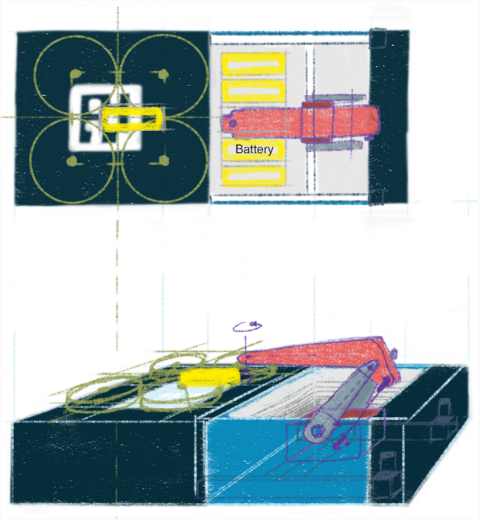
Battery Exchange System

- body of drone fitted with battery locking system
- swapping managed by manipulator
  - must be robust and easy

\+ swapping is fast

– backup power supply for drone needed

- NFC tag
  - for identification
  - tracking of battery during lifetime



Drone Traffic Control

Objectives

- mission accomplishment
- efficient battery utilization
  - maximization of battery charge level
  - tracking of battery during lifetime
- collision avoidance
  - keep the airspace clean
  - possible landing ports around the Droneport for the queue

Trajectory Planning

- considering priority of drone, mission and battery charge level
- numerical solution to optimal control problem
  - transcription to nonlinear program using adaptive pseudospectral element method
  - initialization using solution from graph-based method (such as RRT* or Lazy Theta*)

Conclusion

Comp4Drones

- drone framework
- relevant use cases

Autonomous Drone Battery Management

- Droneport
- battery exchange system
- drone traffic control