Project Proposal

Trajectory Generation and Following with Position Correction

Team: Crash Pilots

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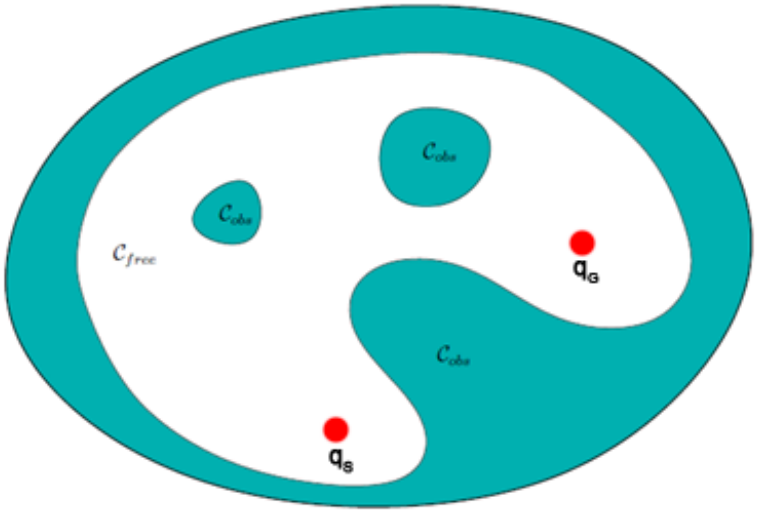
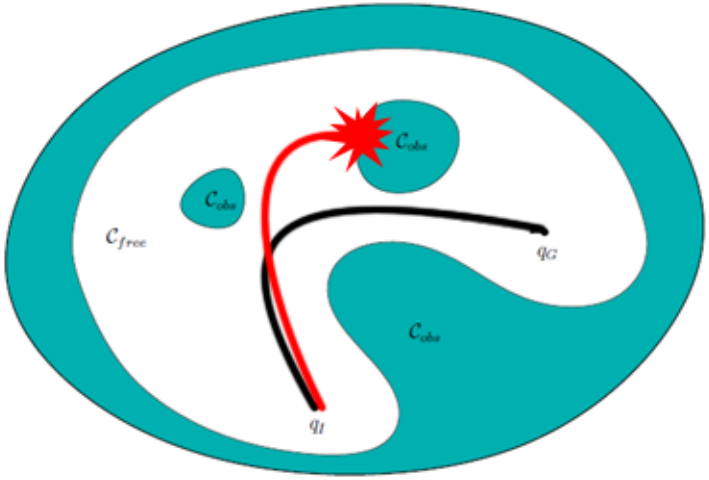
Motivation

- Autonomous flying requires **path-planning ➔** for **optimality** and **collision avoidance**
- Quadrocopter should fly along defined path as closely as possible ➔ **use e.g. visual landmarks**





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Problem Formulation

1. Given a set of predefined **waypoints** $V = \{q_s, q_1, \ldots, q_{n-1}, q_g\}$
   with **edges** $E = \{(q_s, q_1), (q_1, q_2), \ldots, (q_{n-1}, q_g)\}$
   a **trajectory** $\theta(t) = (x(t), y(t))^T$ should be generated for the quadrocopter such that:

$$\theta(0) = q_s \qquad \frac{d\theta(t)}{dt} < v_{max}, \forall t$$
$$\theta(t_{end}) = q_g \qquad \frac{d^2\theta(t)}{dt^2} < a_{max}$$
$$\theta(t) \in \mathcal{C}^1$$

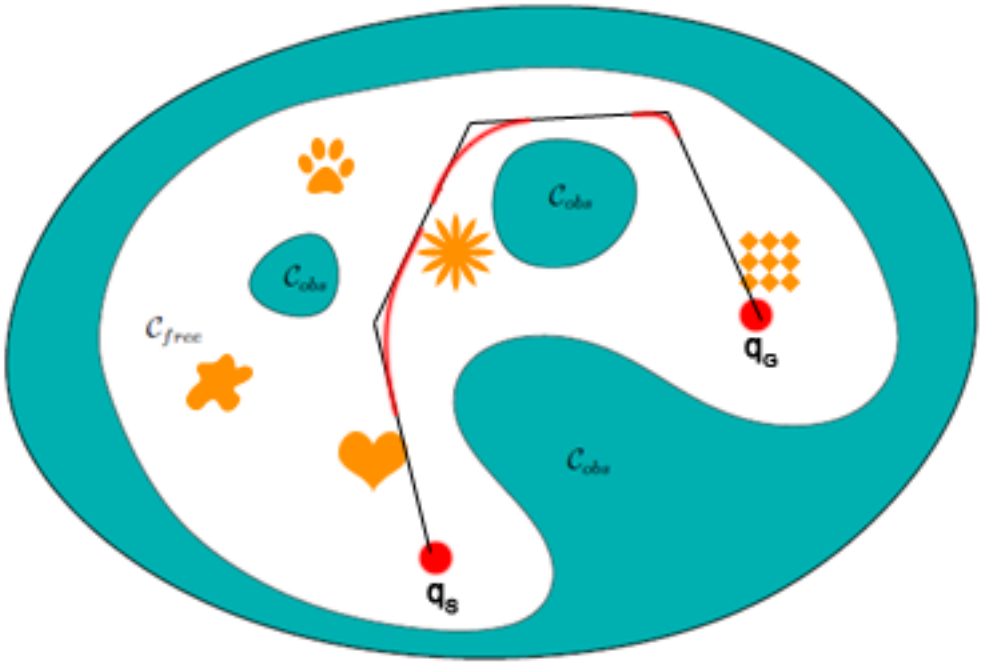
2. The quadrocopter should fly along the computed trajectory, **update** and **correct** its position according to **external sensor measurements ➔ Minimizing distance to real path**

Approach

1. **Using parabolic blends** (for $\theta(t) \in \mathcal{C}^1$) for a coarse user-defined path on a given map

2. **Landmark detection**
   correct position with known positions of several landmarks

3. **Control law (PD-Controller)**
   following the trajectory and handle path corrections



Outlook

Towards more higher accuracy and flexibility:

1. **Autonomous planning with collision aviodance**
   - no user-defined path

2. **Continous pose estimation and correction**
   - no predefined landmarks necessary