Visual Navigation for Flying Robots – Project Proposal

Autonomous Landing on the Moving Platform

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Motivation

- Controlled landing in difficult environments
- Following the marker implicitly
- Control with the Android Smartphone
State Graph

Control Command from the mobile → Manual Control

Landing on the Marker (PID) → Estimate the Position (EKF)

Following the Marker (PID) → Find the Marker

Find the Marker → Control Command from the mobile
Problem Specification

- Extended Kalman Filter:
  \[
  \bar{\mu}_t = g(\mu_{t-1}, u_t)
  \]
  \[
  \mu_t = \bar{\mu}_t + K_t(z_t - h(\bar{\mu}_t))
  \]

- PID controller:
  \[
  u_t = K_P(x_{des} - x_t) + K_D(\dot{x}_{des} - \dot{x}_t) + K_I \int (x_{des} - x_t) dt
  \]
Problem Specification

- Safe landing:
  - Iteratively shrink the distance between the landing platform and the quadrocopter
  - Changing the desired position dynamically in the PID controller
  - If quadrocopter height is below certain threshold → land on the platform
Approach

- rosjava on Android for mobile control (Sebastian Nagel)
- EKF for position estimation (Karol Hausman)
- PID controller for remaining in the desired position (Karol Hausman)
- Landing on the moving platform – generate the trajectory for safe landing (Ross Kidson)
Implementation Plan

1) Mobile control and Landing are separate tasks → better collaboration in the group

2) Implement landing on the static platform, test the performance

3) Implement landing on the moving platform, test the performance

4) Add the mobile control
Challenges and Future Work

- Working on the real robot → uncertainty about the performance in different environments

Possible extensions:
- Mobile interface to control many aspects of the robot → written on Android
- Landing on the moving platform without the marker
- Identification landing zones
Autonomous Landing on the Moving Platform

Questions?

Thank you for your attention.