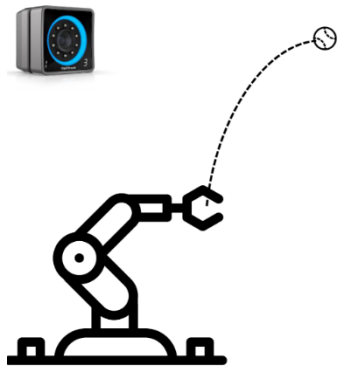




PhD/Master thesis for the research group "Unmanned Flight Systems (UAVs)"

Catching Objects with a Robot Arm

The project aims to build a robotic system that reliably catches a thrown ball with a multi-DOF arm. An OptiTrack motion-capture setup streams 3D ball positions, and a drag-aware predictor estimates the intercept point and time with quantified uncertainty. Control is cast as a reinforcement-learning problem layered on this model: a policy (e.g., SAC/TD3 trained in simulation with domain randomization over throw speed, angle, spin, latency, and noise) maps the robot's joint and end-effector state plus the predicted intercept to safe velocity or waypoint commands.



At runtime, the pipeline is OptiTrack sensing → filtering and trajectory prediction → policy inference → time-optimal motion generation → synchronized grasp, with continuous corrections as new measurements arrive and a safety "shield" enforcing torque and joint limits. Performance is evaluated by catch rate, spatial/temporal intercept error (mean and 95th percentile), motion smoothness/energy, and end-to-end latency, with ablations against heuristic baselines and under sensing delays. Meetings can be held in English or German.

Your tasks

- Real-time tracking of the ball using the camera system
- Predicting the motion of the ball based on measurements
- Steer the robot to a catching position

Your profile

- Programming with C++ and Python
- Experience with ROS 2
- Experiment and Simulation

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